SUPER-SMOOTH MACHINE ERICKSON'S "MIGRATING CHAMBER" T.20

MODEL Airplane NEWS

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AirAGE

EDITORIAL

BY DEBRA SHARP

The flying field at home

Like many modelers, you probably spend this time of year hunkered down in your workshop, diligently building and repairing the airplanes that you'll take to the flying field in the spring. Now there's an alternative: how about spending part of the season perfecting your piloting skills on a flight simulator? You prefer to fly with others? No problem; do you know that there's a way to bring the camaraderie of the flying field to your personal computer?

Model Airplane News sponsors three listserves that allow modelers worldwide to exchange ideas and share experiences. When you join a listserve, you automatically receive every email that is sent to the list, and you can email everyone else on the list. (You might prefer to join a "digest version"—one or two daily emails that contain many messages instead of individual ones.) The SFRC mailing list is for slow-flight enthusiasts; "Soaring" is for sailplane and glider devotees; and FFML is for free-flight modelers.

To join any of these, go to www.modelairplanenews.com/lists. The modelers in these online communities are among the hobby's most helpful and devoted enthusiasts, and we think that you'll benefit from the information and enjoy the fellowship that these listserves provide.

AEROBATICS EXPLAINED

The rolling circle is widely regarded as one of the most difficult aerobatic maneuvers, and it's always a showstopper. This month, "IMAC Aerobatics" contributor Dan Wolanski analyzes the sequence, details each element and shares the practice secrets of the pro's. There's no doubt that mastering the rolling circle takes time, but this article might be your blueprint to success.

SCALE MASTERS 20TH ANNIVERSARY

Model Airplane News contributor Jerry Nelson traveled to Arizona to capture the 20th anniversary of the Scale Masters Championships on film (page 26). This topnotch event attracts the best scale competitors in the U.S. and Canada, and Jerry's stunning photographs capture all the details of their incredible models, each of which took thousands of hours to build. We congratulate *Model Airplane News* columnist Greg Hahn for his win in the Expert Class.

Those who aspire to scale competition shouldn't miss Gary Allen's Bücker Bü-133 Jungmeister (page 52)—a 1/3-scale design featuring traditional balsa-and-ply construction and an accurate scale outline. The plan comes with illustrated instructions to help simplify the installation of the wing rigging wires. Powered by a Zenoah G-45, the Bü-133 looks as good in the air as it does on the ground and could easily put you in the winners' circle.

The noon flightline at the 20th Scale Masters Championships (photo by Jerry Nelson).

RC DESIGN CONTEST REMINDER

You could win $1,000 and have your design published in *Model Airplane News* as a featured construction article! Design and build a model airplane, and send us its specifications and a few photos of it in the air and on the ground by June 1, 2000. All types of RC model aircraft are eligible. (For the complete contest rules, see page 76.)

We're all looking forward to seeing your original designs!

MODEL Airplane NEWS

FOUNDED 1929

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MAIN COVER IMAGE: Mike Barbee's gorgeous Waco captured by Jerry Nelson during the twentieth annual U.S. Scale Masters. Jerry's coverage and stunning photography begins on page 26. Insets: the Erickson MCC FE-120 is a revolutionary powerplant far different from rotary engines. The Hobby Hangar Hawker Typhoon takes the small plane market by storm.

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AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

And The Winners Are ...

We at *Model Airplane News* would like to extend our thanks to everyone who entered the January 2000 Jo Kotula cover contest featuring the P-47. This Thunderbolt first appeared on the cover of our August 1957 issue, and it graced our cover again in February 1962 for the 25th anniversary of Jo Kotula's exclusive artwork for *Model Airplane News*. Many knew both dates, but either answer was acceptable. Thank you for the fond memories you shared with us regarding those original issues.

Here are the five winners chosen from the first 50 correct entries we received. They will each receive a free, one-year subscription to *Model Airplane News*. Congratulations!

Charles Backman
Madison, WI

Kenneth W. Davis
Humble, TX

H. R. Nelson
Richmond,
British Columbia, Canada

Chris Rossbach
Gloversville, NY

Robert Lonseth
Sylvania, OH

MUCH ADO ABOUT MICRO

This letter concerns the February 1999 "Final Approach" by Alexander Van de Rostyne. I, too, have dreamed of microminiature RC flight, and I, too, share a love of rotary-wing aircraft. His accomplishment should set the European indoor hobbyists reeling! In his article, he mentions his discovery that short blade length and wide blade surface area was most efficient for his design, but he couldn't fathom why. After reading his article and taking a 30-minute nap, I think I can explain it in simple terms without a lot of complex physics and math.

First of all, Alex was "missing the forest for the trees." One difference between his micro heli and a larger scale model is its powerplant. A larger aircraft can support a powerplant that produces far more rpm with greater torque, while the micro version must rely on a much smaller and, therefore, weaker powerplant, which results in fewer rpm and reduced torque. A full-size heli's rotors can overcome the great amount of drag caused by its length to cut through the air along the leading edge, but the micro counterpart doesn't have enough torque to do the same. It must reduce the drag produced by its leading edge the only way it can: its smaller profile.

Blade width can be explained in the same way. This time, let's used fixed-wing aircraft to explain things more clearly. First, look at a more highly powered aircraft: a jet. Its smaller wing surface provides lift by affecting a greater amount of air in any given amount of time, i.e., it moves past more air per second. Meanwhile, its low-powered forebears—the bi- and triplanes—need much more lift because of the reduced speed. Less air per second means that more wing surface is needed to maintain lift. Alex's models enjoy less rpm, so the tradeoff is wider rotary blade for more lift.

Please pass these thoughts on to Alex with my personal thanks for doing something I never had time to do. His model is truly a dream come true, and of course, it's a credit to the originality and tenacity of modelers everywhere. Good job. Keep the information flowing, and we'll keep the aircraft going!

LOUIS M. JOHNSON JR.
Placercille, CA

Thanks for the response, Louis. After all, this is the purpose of "Airwaves": to provide a place where modelers can get together and discuss theories and ideas. The possibilities of micro RC are limitless. Every day, unique models are brought (or flown) to our attention. Keep your eyes open because this is just the beginning! GC

FOKKER SEARCH

In the December '99 "Air Scoop," there is a photo of a VK-Fokker triplane next to some artwork from Arizona Model Aircrafters. It says that the "model is not included," but that's what I'm really interested in! It's a beautiful plane; was it built from a kit? Plans? Where can I get it? Please help! [email]

GORDON MALLEY

Gordon, I built this all-wood, ⅙-scale triplane from a VK kit, distributed by Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002; (503) 678-1342; fax (503) 678-1342. My model is powered by a Saito .56 and is covered in Stits Lite cloth and paint. It's an excellent kit, and its outline is very true to scale. GY

NO MORE GASKET GUESSWORK

I just read your article, "Death to Evil Air Leaks"—very good. Right before I read it, I was wondering if I could use a gasket maker from Permatex. Voila; the answer! But one little detail is missing. In your article, you explained how to use the product in almost every part of the engine except the one I'm really having trouble with: the engine's head. My question is this: could we use your technique of the gasket maker on the engine's head to replace the head gasket, taking into account that it's the engine's hottest part? Thank you for your great articles. [email]

JORGE MALAPI

Jorge, head gaskets are made of soft metal—either aluminum or copper—and perform a dual function. The first, of course, is to seal the mating surfaces of the head and cylinder flange. The second function is to supply the correct, very critical clearance between the "squish" area in the combustion chamber and the top of the piston. For this reason alone, the sealing method I used in the article "Death to Evil Air Leaks" could not be used for the cylinder head, even if the sealant could withstand the combustion chamber temperatures—and I'm sure it couldn't. CC

New products and people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will at times cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI

Big Yeller!

An old RC friend

If you truly have an aviation-friendly heart, then you must also have a soft spot for that venerable prodigy of William T. Piper's: the J-3 Cub. Deeply ingrained in the history and flavor of general aviation, the Cub stands out as an original icon for anyone who has his head in the clouds. Arguably, the Cub is the most recognizable and surely one of the most modeled civilian aircraft of all time.

Global has a big winner on its hands with its new, ⅓-scale ARF J-3. Yes; ⅓ scale and intended for 45 to 50cc gas engines. This giant Cub has an impressive 11-foot, 8-inch span and comes totally built and covered. Also included in the deal are a factory-painted engine cowl, aluminum landing gear, a two-piece, plug-in wing and removable tail surfaces. This affordable, definitely IMAA-legal model is slated for release in summer 2000. Keep your eyes open; a "Field & Bench" report is already in the works.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

LANIER 1/4-SCALE TAYLORCRAFT

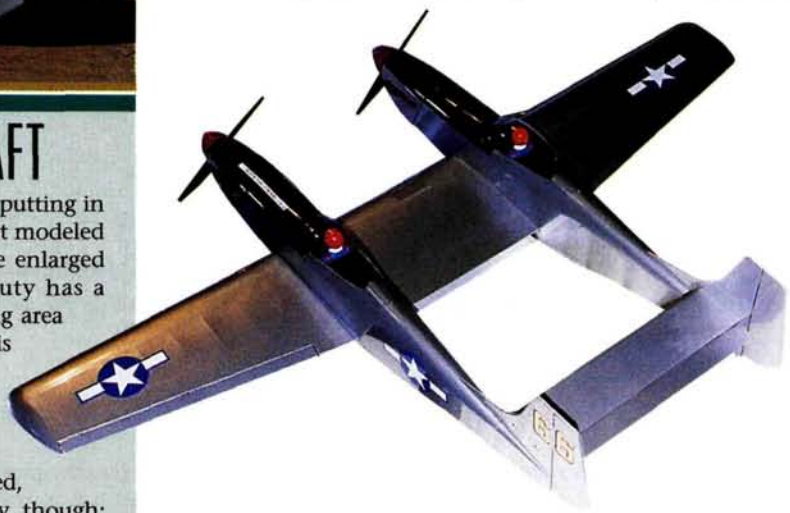
Well, Bubba and the rest of the folks at Lanier RC must be putting in some extra hours. They've just released a new Taylorcraft kit modeled after Mike Swick's super-aerobatic versions, including the enlarged control surfaces and clipped wings. This ¼-scale beauty has a wingspan of 83½ inches, is 69 inches long and has a wing area of 1,336 square inches. The balsa and lite-ply parts for this 12- to 14-pound aerobat have been CNC laser-cut and routed. You also get an ABS cowl and wheel pants, prebent wire landing gear, metal wing-strut fittings, a preformed windshield and working, pop-in, sliding windows and doors! CAD-generated, full-size plans are included, as is a step-by-step instruction manual with pictures. Sorry, though; you've gotta supply your own .91 to 1.20 2-stroke, .91 to 1.80 4-stroke, or G23 gas engine.

If you aren't interested in the clipped-wing aerobat with a wing loading of 20 ounces per square foot, Lanier includes plans for a long-wing Taylorcraft, too. This version's wingspan extends to 108 inches, which makes the wing area 1,678 square inches and the wing loading 19.3 ounces per square foot!

Lanier RC, P.O. Box 458, Oakwood, GA 30566; (770) 532-6401; fax (770) 532-2163.

AIRBORNE P-82 ARF

AirBorne Models has done it again with this all-wood construction "Twin Mustang" ARF. Let me give you an idea just how far the AirBorne folks have gone on this one: the model includes pre-installed retracts, functional split flaps and



detachable wing panels. They've even included transparent dummy cowls to assist you with engine and cowl setup; you won't have to risk messing up the prepainted ones during the building process. I think that's an AirBorne first. Specs: wingspan—70.6 inches; wing area—734 square inches; flying weight—9.5 pounds; engine requirements—two .32 to .40 2-strokes, or .48 to .52 4-strokes; 6-channel radio with nine servos required.

AirBorne Models, 2127-H S. Vasco Rd., Livermore, CA 94550; (925) 371-8922; fax (925) 371-0923.

KYOSHO

A New Sensation

If you've been flying for any length of time, the name Hanno Prettner should ring a bell. If you've been out of the loop (pun intended), Hanno is a world-renowned aerobatics champion and a very accomplished RC airplane designer. He has brought his tournament-winning designs to sport fliers with the new Sensation 1400 ARF from Kyosho. The first thing to hit you about this all-balsa plane is its eight-color, rainbow-checkerboard color scheme separated by ¼-inch chrome pinstriping; no in-flight visibility concerns here! The Sensation also features a fiberglass, gelcoated cowl and wheel pants that match the covering. The hardware, fuel tank, aluminum landing gear and nylon engine mount are all included with the Sensation 1400, so dust off your .32 to .51 2-stroke or .52 to .70 4-stroke, and go fly! Specifications: wingspan—55 inches; wing area—558 square inches; weight—4.85 to 5.5 pounds; length—51 inches; radio—4 channels with five servos.

Also shown, straight from Japan, is a shot of Kyosho's new G.Trick 90. I can't tell you much about this one, other than that it has about a 66-inch wingspan, and it features a ventral tuned-pipe tunnel for .90-size power. I've checked with Great Planes, and no information is available concerning when—or even if—this kit will be imported to the USA.

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-1104.

Fast or slow—have it your way

Foamie Fighting

Ken and Jim Dickman of JK Aerotech have just released their 1/12-scale combat P-51. This little foamie is made out of pink Styrofoam with die-cut Coroplast tail sections and front fuse doublers. They tell me that after four or five hours of building, you'll end up either with a lightning-fast, ½A-powered dogfighter or a park flyer equipped with micro electronics and a Speed 400 motor. Its 38-inch wingspan and 25-ounce weight mean that the combat version will have a wing loading of only 12.5 ounces per square foot! However you choose to fly it, this 2- to 4-channel Mustang looks as though it will be a durable one.

JK Aerotech, 10800 SE Orient Dr., Boring, OR 97009; (800) 442-6755.

SPY SHOT

Thought you guys might like a sneak peek at this Spad XIII. It's the latest to join 3 Sea Bees' highly prefabricated ARF WW I series of models. Stay tuned!

RJL buys K&B

There have been many rumors and much concern about whether products from K&B Mfg. will continue to be available. I'm happy to tell you that K&B has moved to California and has joined the MECOA (Model Engine Company of America) and RJL group of model engine companies under a new name: K&B Model Products.

Since 1946, K&B has been a leader in aircraft and marine model engines, epoxy paint, glow plugs, microballoons, fiberglass and fuel. Under its new management, the entire K&B line will be available, including the recently developed 4-stroke glow plug that has shown much promise. In the beginning, however, fuel quantities will be limited.

The new owners, Randy and Anching Linsalato, felt that acquiring K&B—and keeping it here in the U.S.—was important to American modelers and to American business. We at *Model Airplane News* are happy to see this icon of the modeling industry survive and thrive.

K&B Model Products Inc., 1630 S. California Ave., Monrovia, CA 91016; (800) 632-6269; fax (626) 359-9527.

So many designs ...

... so little time

All right; let's face the facts. We all want more models than we'd ever have time to build for ourselves. So why not let someone else build a few of them for us? Especially if they're built like Great Planes' new, IMAA-legal J-3 Cub. It's (obviously) a scale subject, all of its major assemblies are constructed of wood, and it's covered with woven cloth fabric. Add a fiberglass cowl and exposed engine cylinders, and you've finished. Many of us would like to add a Cub to our flying stable, and now we can have one in a couple of days instead of a couple of months! This also leaves us more time to work on that built-up, must-have Mustang. Great Planes has done the hard part already, *and* they've done it in exactly the way you would have—if you had the time. The Cub is finished with Coverite's 21st Century fabric, and you can use the supplied decals to make authentic "N" numbers, or just leave it "plane." Oh, yes; come spring, check out the Great Planes float kit for the Cub. Specifications: wingspan—81 inches; wing area—984 square inches; weight—8.5 pounds; radio—4-channel with five servos; engine—.40 to .46 2-stroke, or .48 to .70 4-stroke.

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-110.

A bird dog's delight

No, this isn't a Sopwith Pup. I call it the "Ringer Spaniel," and it's Sophie's favorite. It's powered by an Enya .19, has about a 32-inch "ring" span and uses a 3-channel radio. It's great; whenever the Ringer Spaniel goes dead-stick and doesn't make the field, Sophie—with her soft-bite, bird-dog grip—retrieves the model. Oh, yes; Sophie's likeness is the gnaw—I mean yaw—control.

The Ultimate ARF

Goldberg's Ultimate 10-300 – quite possibly America's favorite sport model biplane ever since its introduction back in 1990. You've certainly watched one, possibly piloted one. There's even a good chance you've built one and flown the heck out of it.

Or maybe you're one of those guys whose building time is really scarce and, well, let's face it, a biplane has *two wings*.

ULTIMATE BEAUTY RIGHT OUT OF THE BOX

This is an ARF that will take your breath away. First off, there's the beautifully painted fiberglass cowl and wheel pants, to go with the UltraCote® premium polyester covering. Then there's the one-piece wings, dual aileron servo installation, pull-pull rudder cable system, and recessed I-strut connectors for streamlined appearance. And to top it all off, there's a black molded cockpit insert and a full set of mylar decals.

Deluxe hardware and just a few pre-finished pieces make assembly a snap.

ULTIMATE PERFORMANCE

Nothing flies like a Goldberg Ultimate – except this Ultimate ARF. Frankly, even we are amazed at how exactly the flight characteristics of this almost-ready-to-fly match the kit version. It's just as straight-tracking and docile, when you want it to be. But turn it loose and you'll thrill to its phenomenal knife-edge capability, on-the-button snaps, and long, smooth slow rolls. And when you're ready to return to earth, you can count on its slow-as-a-walk, feather-soft landings.

ULTIMATE VALUE

This package brings you the ultimate in ARF value. Along with the pre-finished fiberglass, you'll find an aluminum gear and cabanes, a Klett steerable tailwheel, plus other quality hardware from American manufacturers: a large 16-oz. fuel tank, top-quality wheels and push-pull switch, fiberglass elevator pushrod, and a glass-filled engine mount. And, as always, you'll appreciate the UltraCote® covering for its superb durability and fast, no-hassle repairs, when needed.

CARL GOLDBERG MODELS INC.

1-800-6FLYING

So don't just dream about flying your very own Ultimate 10-300. The Ultimate ARF – and ultimate thrills – are available at your local hobby dealer.

THE ULTIMATE 10-300 ARF
Wingspan: 54"
Wing Area: 980 Sq."
Length: 58-1/2"
Flying Weight: 7.5 to 8.5 lbs.
Power: .60 2-cycle
.90-1.20 4-cycle
Kit includes: fiberglass cowling and wheel pants, canopy, molded cockpit insert, glass-filled nylon engine mounts, wheels, and 16-oz. fuel tank.

The Ultimate 10-300 ARF. From Carl Goldberg Models.

PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

1/3-SCALE AKROBAT

Mike Ingram's 1/3-scale Stephens Akro was built from Bob Morse plans. With its Brison 4.8 engine and Airtronics radio, this model was completed at 1 a.m. on the day Mike left for the LaGrande Scale Masters contest. It took him two years to build, but it was worth it: after only three flights, Mike took first place in the Sportsman class at LaGrande.

SCRATCH-BUILT SUPER ACE

Shock-absorbing landing gear and MonoKote covering are just two of the features of Robert Worley's Corbin Super Ace. Living in Upper Arlington, OH, Robert started his project by enlarging the plans for the rubber-powered plane. He then converted it to nitro RC by adding a 3-channel radio and a Medallion .09 engine.

LUCKY STRIKE

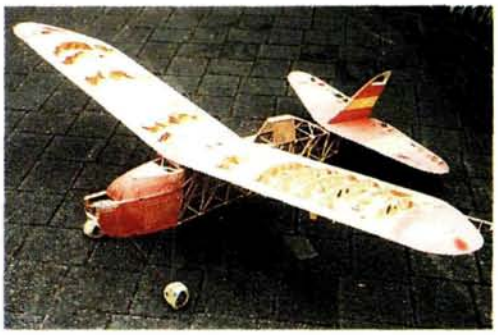
This F-4J was built by Michael O'Donnell of Poway, CA. It was detailed using the scheme of the "Shamrocks"—the first F-4J marine squadron to be deployed on an aircraft carrier. In July 1972 during the Vietnam War, the Shamrocks became the only marine squadron to chalk up an air-to-air kill in a marine plane with an all-marine crew. This Great Planes kit has a SuperTigre 75 engine, Spring Air retracts and Robart struts.

AIRWORTHY SEAHAWK

This Curtiss Seahawk SC-1 started out as a Steve Milos 3-view. Robert Lambert obtained these schematics, enlarged them and used them to build his model. He had served as captain on the USS *Springfield* in WW II, and flew this aircraft. The model has a 56-inch wingspan, is powered by an O.S. 61 engine and uses six servos for control. It's sheeted with 3/32-inch balsa and covered with MonoKote.

A WHOLE LOT OF FUN ... FLY

"Purple Panther" is the name of this huge, 84-inch-span fun-fly plane, scratch-built by Daniel Stacko. His son Jeff no doubt likes its speed, size and aerobatic capability. With a Futaba 8U transmitter, Hitec Super Slim receiver and G62 engine, this craft is capable of unlimited aerobatics, including knife-edge circles, hovering and Daniel's favorite maneuvers—upright and inverted flat spins and waterfalls.



RESUSCITATED SPORTSTER

This sportster belongs to Rex James of Hamilton, New Zealand. Someone started building it in the late 1930s, but the original builder had problems with it, so it just sat, unfinished, in an attic for more than 50 years. Rex was given the unfinished Sportster last year and breathed life into it with an O.S. .25 and a 3-channel radio. He says it is stable and easy to fly, but now it sits displayed on a bookcase, and the original GHQ engine lives in the family's china cabinet.

PENNSYLVANIA BRONCO

Few in our hobby have *not* heard of Rich Uravitch, who is known for his great OV-10 Bronco, among countless other plans and kits he has created. Vince Cahill of Milton, PA, no doubt found the Bronco impressive because he decided to model one himself, using the Uravitch-designed Hobby Hangar kit. Two O.S. .25 engines move this 54-inch-span, 52-inch-long plane. After doing such a nice detailing job, though, Vince notes, "I think I'm just going to look at it for a few months before I try to put it in the air."

IT HAD TO BEE YOU

This plane was built from an Andy Clancy Lazy Bee kit. When the paint job was finished, Simon Langis named the plane the "Bourdon" (or bumblebee, in English), and we can see why. If you're going to fly a Bee, it might as well look like one, right?—at least, this is probably what Rimouski, Quebec, Canada, resident Simon was thinking when he built it. He covered the fuselage with MonoKote and the wing with Micafilm, then put an O.S. .10 in the model. "It flies like a real 'bourdon,'" Simon notes.

PROMINENT P-35

The P-35 Seversky has enough history to fill a book. Clark Gable's character flew one in the movie "Test Pilot," and Jacqueline Cochran raced one at 249mph to win the 1938 Bendix Air Race. Originally a Cleveland rubber-powered model, Ed Pease's Seversky weighs 7½ pounds and is powered by an O.S. .65, which will no doubt ensure that Ed's plane will be the source of many more P-35 stories to come in the town of Temecula, CA.

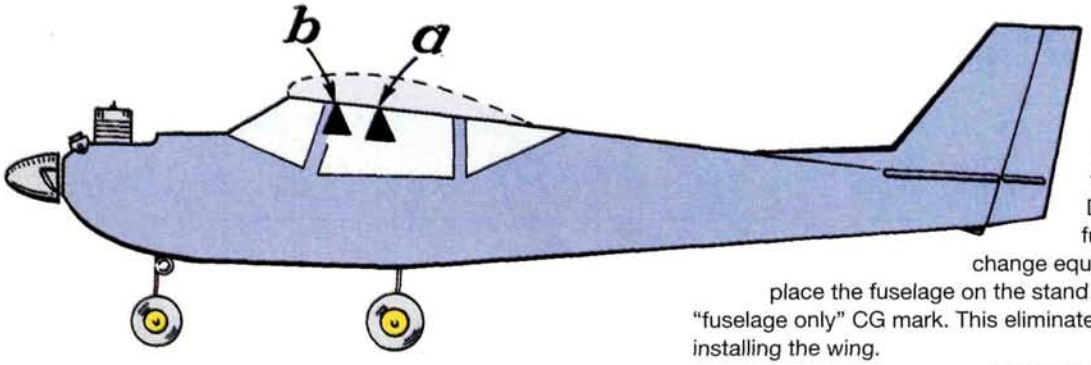
DANISH, ANYONE?

The Danish HM-II floatplane was used by the Danish government to conduct an aerial survey of Greenland during the 1930s. Keith Christensen built his model using an Ed Miller design. It has a 63-inch wingspan and is finished in UltraCote, UltraPaint and Rustoleum (for the decals and ID numbers). The O.S. .46 makes sorties around small ponds and lakes very enjoyable; in fact, Keith likes it so much that he plans to make an electric version from scale drawings.

HINTS & KINKS

BY JIM NEWMAN

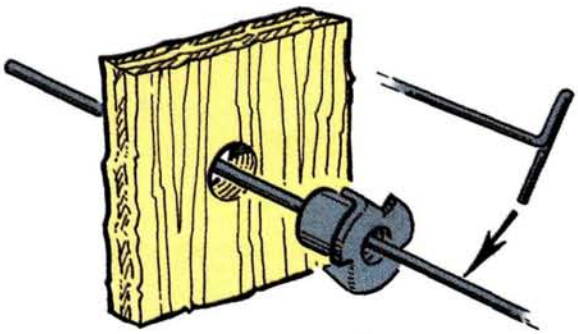
SEND IN YOUR IDEAS. *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



BALANCING ACT

After you've established and marked the correct CG of your plane (a), remove the wing and place only the fuselage on the balancing stand. Determine and mark the CG of the fuselage alone (b). The next time you change equipment or engines, you need only place the fuselage on the stand and balance the plane using the "fuselage only" CG mark. This eliminates the need to continue removing and installing the wing.

Lloyd Ressler, Gerrards Cross, Bucks., England



DELICATE TOUCH

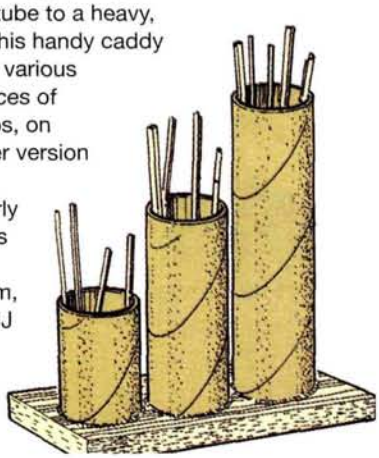
Here's how Fred puts blind nuts into the rear of the firewall: working through the tank bay, he inserts a length of wire through the hole in the firewall, slips the nut onto the wire, then pushes it along with a long screwdriver until it enters the hole. He keeps light pressure on it while inserting a screw and washer to pull it into place and embed the tangs in the plywood. Another trick is to soften the wire and form a "T" on one end. Slip the nut onto the wire, then use it to pull the nut into place.

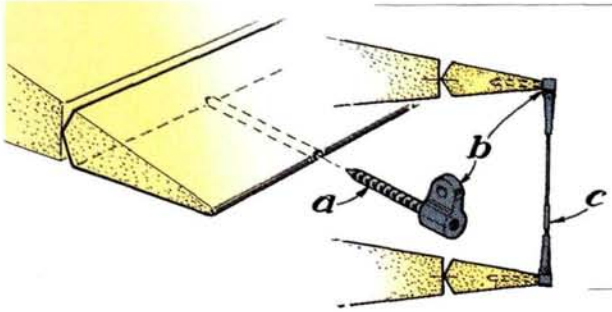
Fred Heddleson, Oak Ridge, TN

THE TUBE LOOK

Glue progressively longer pieces of cardboard mailing tube to a heavy, chip-board base. This handy caddy is useful for storing various things, such as pieces of wood or metal strips, on your bench. A larger version can be made to accommodate nearly full-size balsa sticks and sheet.

Bill Watt, Chatham, NJ





DUAL AILERONS

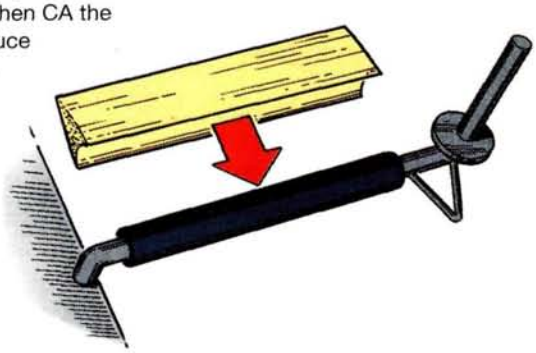
Here is a simple method of linking biplane ailerons using a slave rod and standard components. Cut pieces of threaded rod (a), clean them with acetone, then screw and glue them into holes in the aileron trailing edges. Screw aileron connectors (b) onto the rods, attach a clevis to each one, then connect them with a pushrod that's threaded on each end. The pushrod can be made by threading each end of a piece of welding wire or by soldering a pushrod connector (c) to one end of a threaded rod.

Paul Battenberg, Scarborough, Ontario, Canada

FAIR PRACTICE

It's easy to add fairings to wire landing gear if you first cover the wire with heat-shrink tubing. Clean the shrunken tubing with thinner, then CA the shaped balsa or spruce fairing to the tubing. The fairing can then be lightly sanded and covered with film, fabric, or paint.

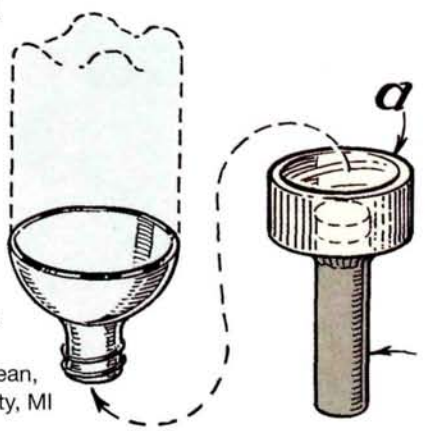
Earle Meyer, Denver, CO



FUNNEL FUN

A funnel can quickly be constructed out of a plastic bottle of a suitable size that has been cut as shown. If a smaller spout is required, make a reducer by piercing the bottle cap and forcing a short piece of plastic tube into the hole.

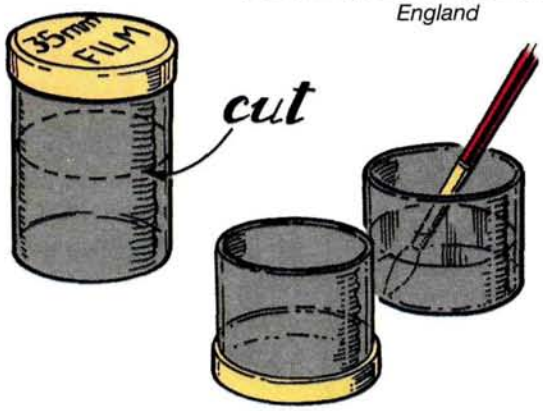
Brian Keelean, Kent City, MI

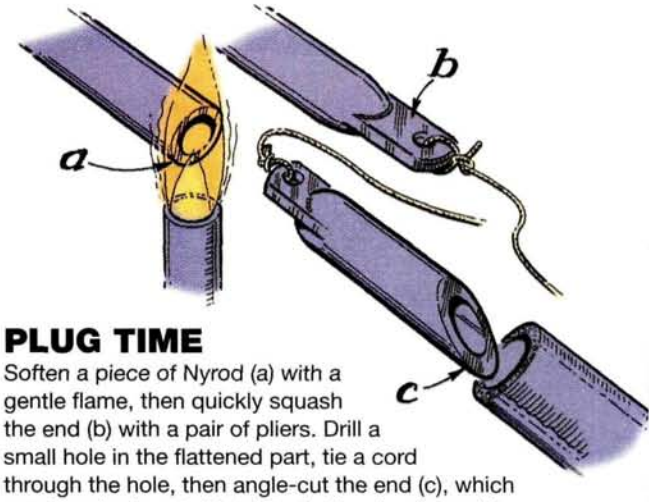


FILM FESTIVAL

Those transparent plastic, 35mm film containers are unaffected by most solvents. What's more, the snap-on lid is leakproof. Cut the container through the middle to make great mixing cups for paints and epoxy.

Gordon Rae, Great Malvern, Worcs., England





PLUG TIME

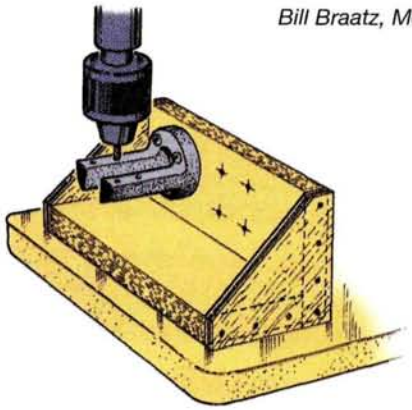
Soften a piece of Nyrod (a) with a gentle flame, then quickly squash the end (b) with a pair of pliers. Drill a small hole in the flattened part, tie a cord through the hole, then angle-cut the end (c), which can then be inserted into the fueling line to seal it. Secure the free end of the cord to the model to prevent loss of the plug.

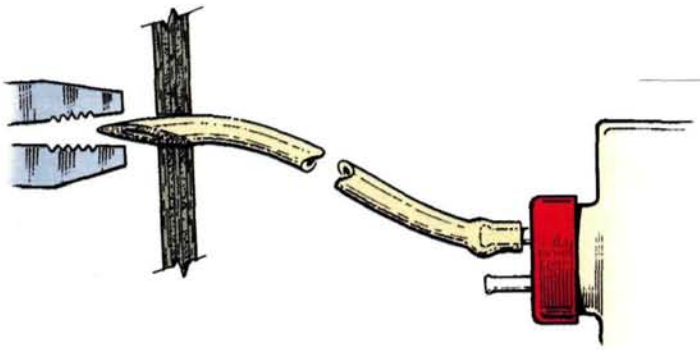
Bill Braatz, Merrillville, IN

PRECISION DRILLING

Bill uses this angle plate because of the vertical accuracy it provides when he drills engine mounts. Use a table saw to cut ¾-inch (75mm), chip-board parts and plywood end braces. Nail and glue the parts together, making absolutely sure that they are at 90 degrees to each other. After marking the engine-mount holes, the mount can be screwed or clamped to the angle plate, and it will stay in place while you drill the holes with a drill press.

Bill Yorke, Niagara Falls, Ontario, Canada





TANK DRIVER

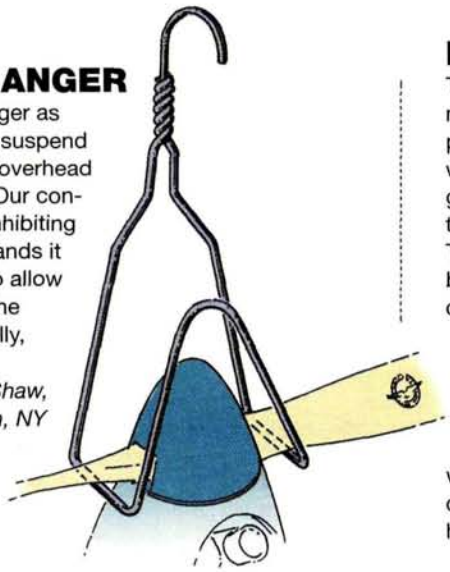
To position your fuel tank more easily when you put the fuel lines through the firewall, try this: attach long pieces of fuel line to the tank pipes, cut the ends of the fuel lines at sharp angles, then insert them through the rear of the firewall. Grasp the protruding ends with pliers, then pull the lines through until the tank is in position, after which you can snip the lines to the correct lengths.

Ed Woody, Scottsburg, VA

AIRPLANE HANGER

Bend a wire coat hanger as shown, then use it to suspend your models from an overhead beam or water pipe. Our contributor shoots rust-inhibiting oil into the engine, stands it nose-up for a while to allow the oil to trickle into the front bearing and finally, hangs it nose-high.

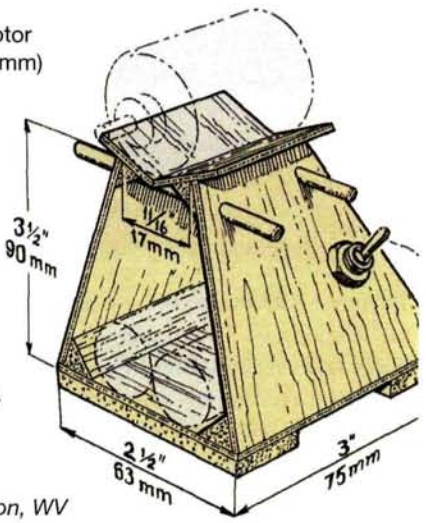
Avey Shaw, Huntington Station, NY

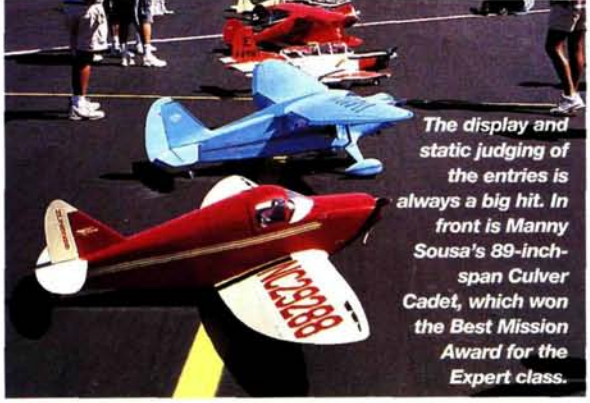


ENERGY PACK

This simple, if inelegant, electric-motor mount was made from 1/16-inch (1.5mm) plywood and balsa triangle stock with strips of rubber sponge glued to the bottom to better fit the wing and prevent damage. The motor is secured with rubber bands to 3/16-inch (5mm) dowels, and the battery pack, shown dotted, slips between the pylon supports where it is held by the same crossed rubber bands as secure the wings to the pylon above. This is very useful if you are at a field that does not have room for winch or high-start launching.

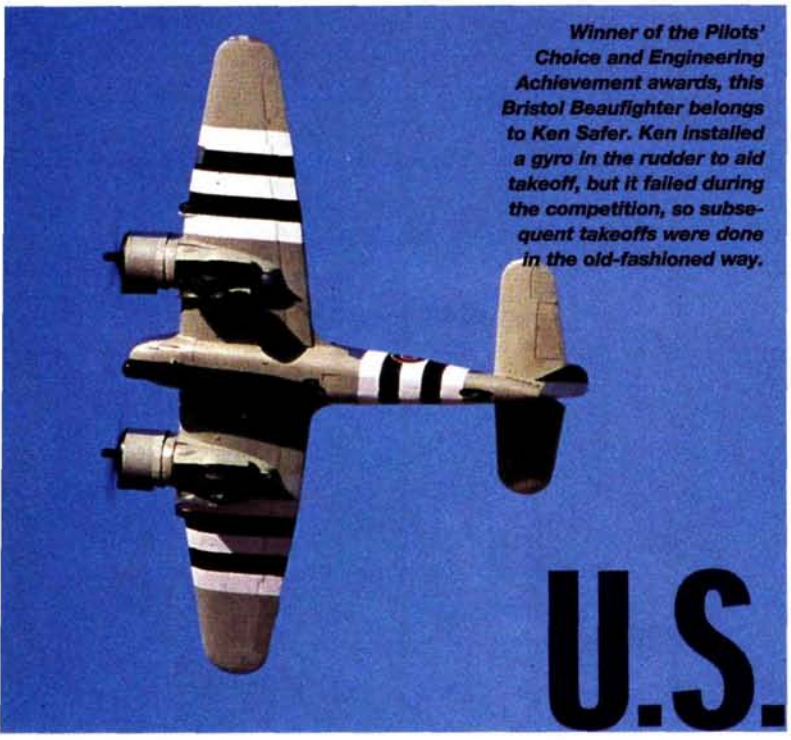
Neil Gibbins, Huntington, WV





The display and static judging of the entries is always a big hit. In front is Manny Sousa's 89-inch-span Culver Cadet, which won the Best Mission Award for the Expert class.

Ernest Harwood of Arlington, TX, brought this 1/4-scale Fokker D-VII to the Scale Masters.



Winner of the Pilots' Choice and Engineering Achievement awards, this Bristol Beaufighter belongs to Ken Safer. Ken installed a gyro in the rudder to aid takeoff, but it failed during the competition, so subsequent takeoffs were done in the old-fashioned way.

This Piper Super Cub PA-18 won the Best Civilian award. Phil Sibille also had the satisfaction of knowing that his 144-inch model was one of the two largest craft there.

U.S. SCALE MASTERS CHAMPIONSHIPS

by Jerry Nelson

Only 0.583 point kept Kent Walters' SBD-3 Dauntless from first place in the Expert class. Finishing second, the Dauntless weighed 23 pounds and had a 74-inch wingspan.

20th anniversary action from Arizona

To many scale modelers, the U.S. Scale Masters Championships is the most prestigious of all the RC scale competitions held in the U.S. and Canada. The Scale Masters isn't intended to be the biggest scale competition—just the best. Obviously, this sentiment is greatly accepted because the event has been held annually for the past 20 years.

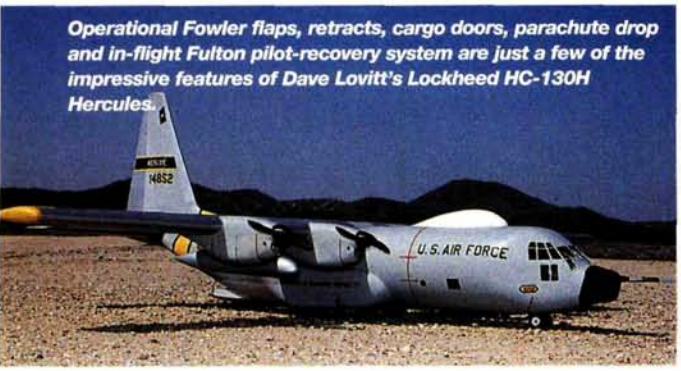
Run by volunteers, currently chaired by Earl Aune and based in Portland, OR, the U.S. Scale Masters Association's championship is so prestigious because its contestants must qualify regionally to earn the right to compete. In 1999, 21 regional qualifiers were held around the country. (Any club with scale contest experience may host a regional qualifier.) During these qualifiers, each of the pilots—not a particular airplane—vies for the chance to attend the Championships, and only 30 percent of the experts and 20 percent of the teams who compete are able to advance. In addition to the qualifiers, the top 10 finalists from the previous year's Championships are automatically invited to participate. This time, slightly more than 100 pilots were eligible; 42 competed. The Championships was supposed to be held at Mile Square in Fountain Valley, CA, but a local property dispute forced the event to be moved. With only 81 days until the event, the Sun Valley Fliers volunteered to host the competition in Phoenix, AZ.

Contest director Michael Peck ran the event perfectly; one would think the SVF had planned to host it all along. Even the weather was excellent, if a little hot (100 degrees) for this Northwesterner.

Two events are held each year at the Championships: Team and Expert. The Team event allows the builder to have a more skilled pilot fly his aircraft. In Expert, the builder is also the pilot. Eight teams and 31 expert contestants participated. Individual awards for both events and many special "best of" awards are given out.

Top and above inset: Mike Barbee's YMF-5 Super Waco won Best of Show at the 1999 Toledo RC show, and it again impressed judges; it took third place in the Expert class and won the Best Golden Age award. Center: Daniel Garrabrant and Richard Skoglund entered a Fokker E.111 and won third place in the Team class. The 1/5-scale Balsa USA kit was the lightest aircraft entered this year. Bottom left: this AMT-powered F-86 Sabre Jet was the only jet entered in this year's Scale Masters Championships. Builder Shailesh Patel of Eureka, CA, won the Best Jet award. Bottom right: powered by a Zenoah G-62, this 25-pound BT-13 belongs to Larry Sutherland.

Randy Claussen and Dan Molinsky entered this P-61 Black Widow as their first entry in the Scale Masters competition, earning a second-place finish and the Best Mission award for the Team class in the process, as well as Best WW II.



Operational Fowler flaps, retracts, cargo doors, parachute drop and in-flight Fulton pilot-recovery system are just a few of the impressive features of Dave Lovitt's Lockheed HC-130H Hercules.

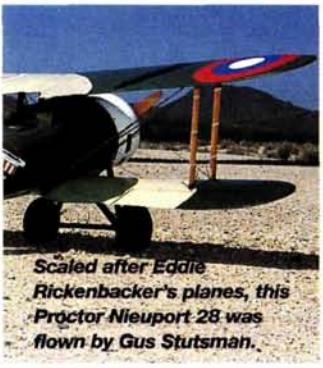
Bob Benjamin's Taylorcraft BC-12D is powered by an Astro 90 motor. Its 12th-place finish was the highest ranking for an electric-powered craft at the Scale Masters.

For modelers who have not attended or competed in scale competitions, here is a brief overview of the event rules. The actual competition (Team and Expert) is composed of two parts: static judging and flight performance. A perfect score is 200 points. The static judging is done before the actual flying and lasts all day. A perfect static score is 100 points (40 for accuracy of outline, 30 for color and markings and 30 for craftsmanship). Contestants must provide 3-view drawings as well as photos and color documentation of their subjects.

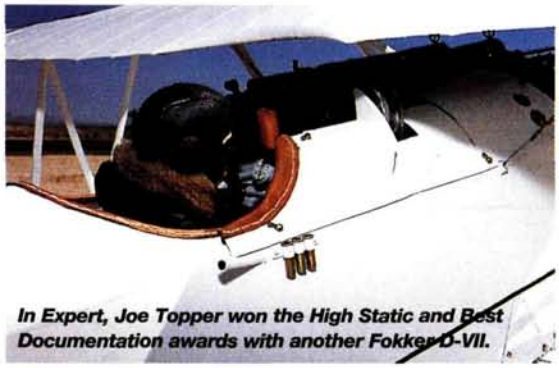
The Best Markings and Best WW I awards went to Gary Parker and his Albatros DVA. Co-owner of Proctor Enterprises, Gary modeled this 1/4-scale Proctor kit after the Stropp DVA Albatros in the Smithsonian's National Air and Space Museum.

The flying portion is also worth 100 points. Pilots must perform nine maneuvers, five of which are chosen by the pilot from an extensive list, and each maneuver is scored from 1 to 10. Typically, the chosen maneuvers are those that the full-scale aircraft was intended to do. An additional 10 points are given for realistic flight.

The flying site was excellent. The sun was always behind both the pilots and the judges. There was a long, paved runway and a dirt runway, which often works



Scaled after Eddie Rickenbacker's planes, this Proctor Nieuport 28 was flown by Gus Stutsman.



In Expert, Joe Topper won the High Static and Best Documentation awards with another Fokker D-VII.

The 1/4-scale Spacewalker II kit made by Sig Mfg. was Richard Skuglund's choice for the Championships.

better for tail-draggers (and is what they were designed for, anyway). The wind was minimal but caused a few problems because it would change as much as 180 degrees from time to time. There were four flightlines organized by radio frequency, so four aircraft were usually in the air at all times. An air boss constantly monitored the air traffic and radioed takeoff and landing instructions to the chief judge of each flightline.

The Sun Valley Fliers organized a noontime airshow each day, and various types of models were flown. The crowd really liked the air-streamer combat models, and Greg Hahn flew his magnificent B-25, too. He dropped his bombs right on target and made several 2-foot-high, full-bore passes. The crowd really got an impression of what scale flying is all about.

A tradition of the U.S. Scale Masters Championships is the public viewing of the models before the noontime airshow.

This prototype Proctor kit was built 10 years ago by Dick Hansen of Portland, OR. Dick's model received the second highest total flight score, the highest Expert-class flight score and the High Flight award.

All the models are lined up on the middle of the runway with the pilots next to

U.S. SCALE MASTERS

EXPERT

Place	Pilot	Aircraft	Scale	Aircraft mfr.	Wingspan (in.)	Weight (lb.)	Covering	Paint	Engine	Prop
1	Greg Hahn	SBD-5 Dauntless	1/5	Ziroli	104	44	Glass	Acrylic enamel	Zenoah	24x10
2	Kent Walters	SBD-3 Dauntless	1/6.7	Own design	74	23	Glass	Aerogloss	O.S.	16x6
3	Mike Barbee	YMF-5 (Super Waco)	1/3	Mike Barth kit	120	47	Stits	PPG	3W-100	30x10
4	Shailesh Patel	F86 Sabre Jet	1/6	Prototype for future kit	72	32	Glass	PPG	Futaba	–
5	Joe Topper	Fokker D-VII	•	Proctor	80	•	Coverite	Lacquer	Laser	•
6	John Cole	Brandenburg	1/4	Own design	•	•	•	•	SuperTigre	•
7	Gary Parker	Albatros	•	•	•	•	•	•	•	•
8	Gus Stutsman	Nieuport 28	1/4	Proctor	80	15	Coverite	Lacquer	O.S.	18x6
9	Dick Hansen	Albatros DVA	1/4	Proctor	88	23	Coverite	CACQ	Enye	18x6/10
10	Eugene Job	Hawker Sea Fury	•	•	•	•	Glass	K&B	3W	•
11	Brian O'Meara	F4U-1 Corsair	1/5.5	Brian Taylor Plans	82	24	Glass	Ace Enamel	Webra	18x10
12	Bob Benjamin	TaylorCraft BC-12D	1/4	Own design	108	22	Stits	Stits	Astro	18x12
13	Bob Frey	P-47 Thunderbolt	•	•	•	•	•	•	•	•
14	Wayne Frederick	Fokker D-VIII	1/4	Own design	83	16	Coverite	Kelly Moor	O.S.	18x8
15	Dave Lovitt	HC-130H Hercules	1/16	Skip Mast plans	102	24	Glass	Hobby Poxy	O.S.	10x4
16	Larry Sutherland	BT-13/SNV-1	1/5	Bert Baker kit	90	25	Glass	Stits	Zenoah	20x6/10
17	Bob Benson	Beechcraft T-34C	1/5	R.T. Associates	80	22.3	Glass	PPG	Moki	16x10/8
18	Richard Skoglund	Spacewalker II	1/4	Sig	84	12	Ultracote	Pactra	Saito	15x8
19	Ward Emigh	Fairchild PT-23A	26%	Modified Hostetler plans	114	36	Coverite	Dope	Robart	26x10
20	Manny Sousa	Culver "Cadet"	27.5%	Vern Clement plans	89	18	Stits	Stits	O.S.	18x6
21	Doug Crumley	Belanca Super Decathalon	•	•	•	•	–	•	•	•
22	Jeff Lovitt	DHC-1 Chipmunk	1/5	Own design	82.5	14.5	Glass	Hobby Poxy	O.S.	16x8
23	Ken Safer	Bristol Beaufighter	1/6	Own design	118	52	Glass	PPG	Saito	20x10
24	Ernest Harwood	Fokker D-VII	1/4	Proctor	88	22	Coverite	Various	Laser	18x6/10
25	Kenny Kear	Liberty Sport	1/6	Sig	57	7.5	Koverall	Sig Dope	SuperTigre	11x6
26	Dan Thordarson	F4U-1A Corsair	1/5	Meister Plans	100	32	Glass	Perfect	Zenoah	20x8/14
27	Bill Curry	Staggerwing E-17	21%	Lee Richter Plans	80	32	Stits	Polytone	Seidel	22x10
28	Charles Baker	PT-26 Cornell	1/5	Own design	72	13.5	Seconite	Acrylic enamel	HP	12x8
29	Earl Muenze	Waco YMF-5	1/5	Modified Pica kit	72	18	21st Century	Dope	O.S.	16x8
30	Phil Sibille	Super Cub PA-18	1/3	Own design	144	40	Stits	Enamel	O.S.	20x10
31	Bruce Estes	Hawker Sea Fury	1=5.5	Jerry Bates Plans	81.5	25	Glass	PPG	Sachs	20x10

TEAM

Place	Pilot/builder	Aircraft	Scale	Aircraft mfr.	Wingspan (in.)	Weight (lb.)	Covering	Paint	Engine	Prop	Fuel
1	Joe Topper/ Dick Heininge	Fokker D-VII	1/4	Proctor	86	24	•	•	•	–	Laser
2	Randy Claussen/ Dan Molinsky	P-61 Black Widow	1/7	Ziroli	114	47	Glass	PPG	Zenoah	20x8	Gasoline
3	Daniel Garrabrant/ Richard Skoglund	Fokker E-III	1/6	Balsa USA	80	10	WorldTex	Pactra	Saito	15x8	PowerMaster
4	Dan Thordarson/ Gary Moullet	Piper Super Cub PA-18	1/3	Balsa USA	144	47	Stits	Enamel	Brison	24x10	Gasoline
5	John Elliot, Jr./ Chuck Maitre	Waco YMF-5	1/5	Pica	72	15.5	21st Century	21st Century	Saito	16x8	PowerMaster
6	Ken Safer/ Lynn Hersh	Stinson SR-8	1/4	Ikon NW	101	26	Coverite	PPG	Zenoah	20x6	Gasoline
7	Eric Malkerson/ Wayne Stewart	P-51 Mustang	1/5	Aerotech	88	28	Glass	PPG	Moki	20x10	Sig
8	Jim Sandquist/ Wayne Stewart	P-47 Thunderbolt	1/5	Aerotech	82	32	Glass	Aluminum	Brison	22x10	Gasoline

• = Pilot(s) did not provide information.

Radio	Static	Top 3 flights average	Total points
JR	98	92.83	190.833
Futaba	98.50	91.75	190.250
Futaba	98	90.25	188.250
Futaba	97.50	89.83	187.333
Futaba	99.50	87.75	187.250
•	95.50	91.50	187.000
•	98.50	87.33	185.833
Futaba	94	91.25	185.250
Futaba	92.50	92	184.500
•	97.50	86.42	183.917
Airtronics	95.50	87.33	182.833
Airtronics	94.50	87.75	182.250
•	91	90.25	181.250
Futaba	96.50	84	180.500
Airtronics	93.50	86.17	179.668
Futaba	93	86.42	179.417
Futaba	94.50	84.84	179.340
Airtronics	92	85.92	177.917
Futaba	93.50	84.08	177.583
Airtronics	90.50	86.42	176.917
•	95.50	81.25	176.750
Airtronics	90.50	86	176.500
Airtronics	93	80.75	173.750
JR	95.50	78.25	173.750
Futaba	97.50	75.67	173.167
Futaba	88.50	83.33	171.833
Airtronics	96	75	171.003
JR	92	78.17	170.167
Futaba	91.50	77.00	168.500
JR	97	52.92	149.917
Futaba	92	27.58 (DNF)	119.583

Radio	Static	Top 3 flights average	Total points
•	94.50	90.92	185.417
JR	91	88.42	179.417
Airtronics	88.50	88.92	177.417
JR	92.50	84.50	177.000
Airtronics	91	82.67	173.667
Futaba	90	80.42	170.417
Futaba	94	13.75 (DNF)	107.750
Futaba	95	0 (DNF)	95

GREG HAHN: FIRST PLACE, EXPERT CLASS

This SBD-5 Dauntless was built and flown by Greg Hahn of Lewisville, IN. Greg won first place in the Expert class with a static total of 98 and a top-three flight average of 92.83 for a total of 190.833. He also took home the "Best Military" award. This 1/5-scale Dauntless has a 104-inch wingspan, weighs 44 pounds and is powered by a Zenoah* G-62. Equipped with a JR* radio, Robart* retracts and Glennis* wheels, this craft was covered with fiberglass cloth and painted with acrylic enamel. Under Greg's control, it demonstrated prototype dive bombing by diving straight down using the operational dive brakes to prevent the aircraft from building up excessive speed. The Dauntless was extremely realistic in flight as well as on the ground.

their aircraft so they can answer questions, and the spectators can take photos up close.

The stats, table and photos tell the story of who was there, who flew what and what happened, but for those modelers who are into scale competition but couldn't attend, here are some highlights.

Only one jet aircraft was entered because the Superman Jet Rally was held in Ohio on the same weekend. Shailesh Patel flew his magnificent AMT* turbine-powered F-86 Sabre. The density of the air at the 3,000-foot altitude seriously affected his takeoff and landing roll, but he was able to fly his model to a respectable fourth place, although he used every inch of the runway to do so.

Of the three Championships I have reported on, this is the first at which it really didn't matter which kind of scale aircraft was entered; any well-prepared and -flown design had a chance to win. High winds normally affect the WW I and Cub/Taylorcraft-type of aircraft quite seriously, so it's almost impossible to get the high flight scores needed to win. The judges do their best, but the

John Elliot and Chuck Maitre's Waco YMF-5. It has a 72-inch wingspan and was built using the 1/8-scale Pica kit.

advantage usually goes to the high-wing-loading aircraft—typically WW II aircraft. But this year, the wind wasn't much of an issue. Dick Hansen earned the second highest total flight score and the highest single flight score with his 10-year-old Proctor* Albatros! His total flight score was only 0.83 behind Greg Hahn's winning Dauntless. The highest static score—99.5 points—went to Joe Topper's Fokker D7. Gary Parker's Albatros tied for second with Ken Walters' Dauntless; each scored 98.5. Overall, the top five consisted of two Dauntless models, a 1/3-scale Waco biplane, an F-86 Sabre jet and a Fokker D7. Only 3.833 points separated first place from fifth.

In the top 10, there were five WW I biplanes, three WW II prop fighters, one 1930 Waco biplane and a jet. It's plain to see that with reasonable wind conditions, the WW I and biplane aircraft are extremely competitive with the heavier warbirds. In the last three Championships, the WW I entries as a group have always placed very high in static judging, but they didn't necessarily get the flight scores they deserved. This year, only 6.916 points separated first place from 10th.

Similarly, in Team scale, there were two WW I aircraft, a WW II Black Widow twin, a Super Cub and a 1930 Waco biplane. At the banquet, Joe Topper (who placed fifth in Expert and first with Dick Heininge in Team, flying Fokker D-7s in both events) made a great comment about the WW I and WW II aircraft. He told the WW II guys, "You may have won the Expert category in this Championships, but don't forget: if there hadn't been a WW I, there couldn't have been a WW II!"

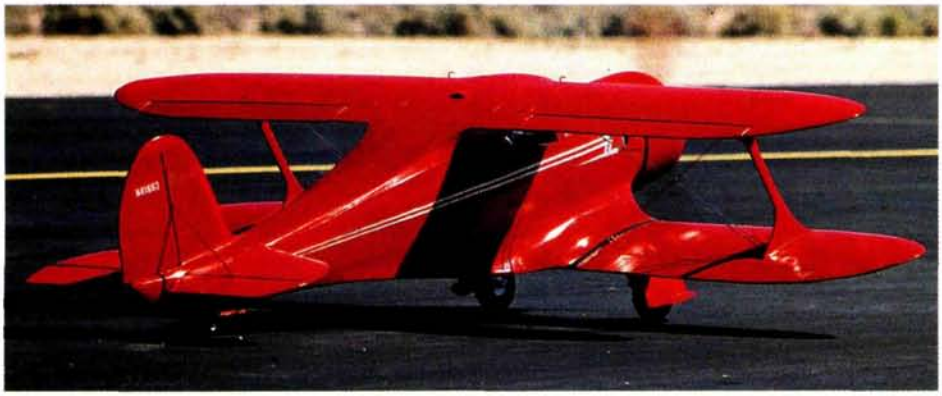
At press time, the date and place of the next Championships had not been finalized, although it will likely be held in September or October 2000. Wherever and whenever the U.S. Scale Masters Championships are held, I will be there, and I hope you will be, too.

If you are interested in supporting, joining, or competing in a U.S. Scale Masters event, contact the organization at 21952 Airport Rd., Aurora, OR 97002; (503) 678-6036; email jenseninc@msn.com.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

JOE TOPPER AND DICK HEININGE: FIRST PLACE, TEAM SCALE CLASS

Attendees at the 1999 U.S. Scale Masters Championships witnessed the commanding presence of WW I aircraft, led by Joe Topper and Dick Heininge's Team scale-winning Fokker D-VII. Both of Sandy, OR, Joe and Dick got a static total of 94.50 and a top-three flight average of 90.92. A former owner of Proctor Enterprises, Dick built this 1/4-scale, 24-pound, 86-inch-span model from a prototype Proctor kit. He then added a Laser* 300V, 2-cylinder, 4-stroke twin engine. Joe's flying skills showed the model to be an excellent flying aircraft. The pair also won the Most Realistic Flight Team award.



The Best Built-Up Kit award went to Bill Curry and his Beechcraft Staggerwing E-17.

John Cole won the Best Scratch-Built Aircraft award with his Hansa Brandenburg C-1. John also won the Most Realistic Flight award in the Expert class.

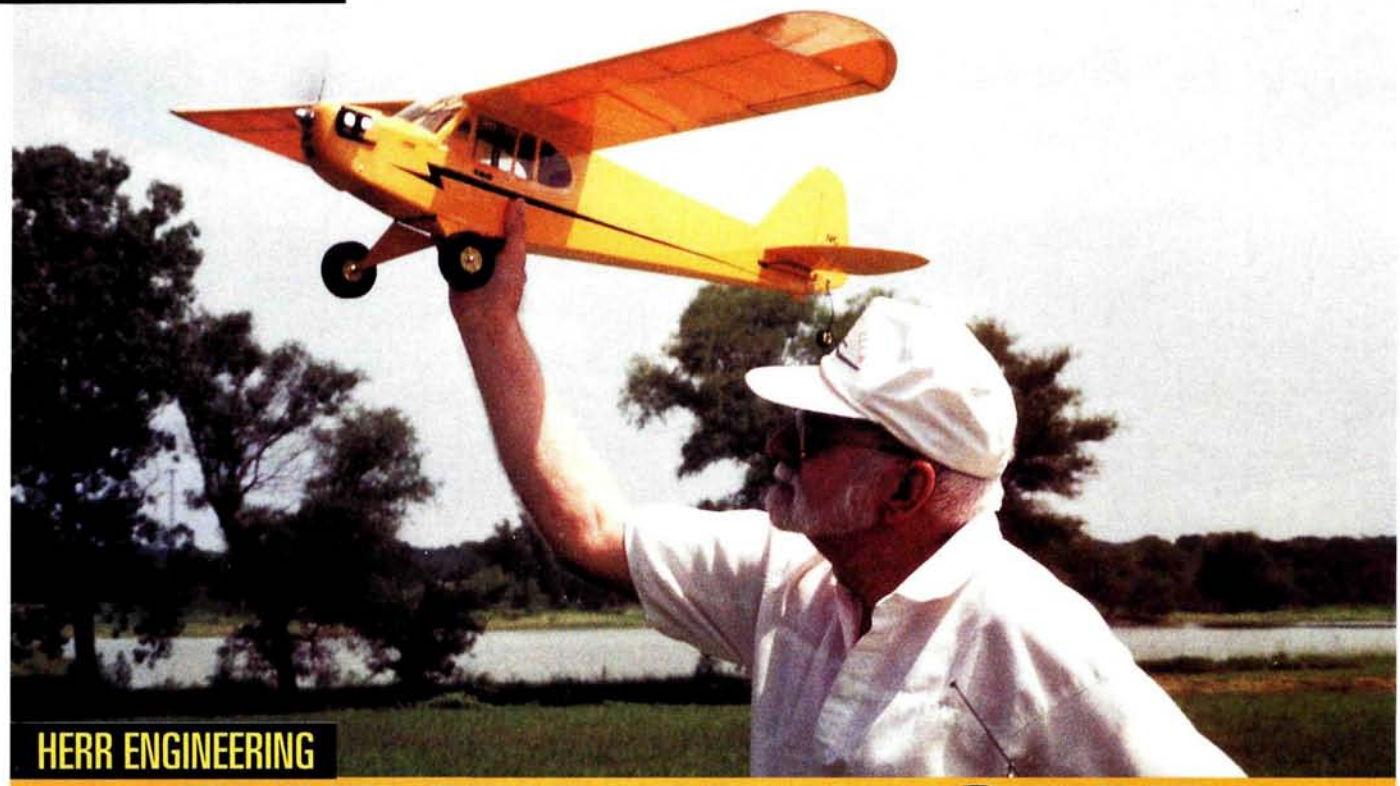
1999 U.S. SCALE MASTERS CHAMPIONSHIPS SPONSORS

Yes, this competition was highly successful, but without the sponsors, there wouldn't have been a competition; the U.S. Scale Masters Association depends on sponsors to operate.

Two "Platinum" sponsors in particular must be singled out: Bob Smith Industries* and Airtronics*. Bob and Chuck Smith of Bob Smith Industries are both avid modelers. They provided significant financial support (as well as excellent shirts!) for the contestants and officials. Airtronics (via John Elliot) also provided major financial support and donated top-of-the-line Airtronics radios to all of the Team scale winners in the 21 regional U.S. Scale Master qualifiers.

Proctor Enterprises* and Pacer Technologies* were the Silver sponsors, and Futaba*, Gonder Enterprises, Horizon Hobby Distributors*, Robart Mfg.* and Vailly Aviation* were the Patron sponsors. The Associate sponsors—Aerotech Models*, Hansen Scale Aviation Videos*, Jet Hangar Hobbies*, Interactive Flight Concepts, Pinnacle Infinity, Dennis' Lawn Service and Gene Barton Landing Gear*—gave financial donations and services. Thanks must also go to the following for their financial support: Schlotzsky's Deli, Scale Model Research*, Nick Ziroli Plans*, One Eighth Air Force and Bob Holman Plans*.

A laser-cut, ½A-scale sport flyer



PHOTOS BY RANDY RANDOLPH

HERR ENGINEERING

PIPER J-3 CUB

by Randy Randolph

HERR ENGINEERING* KITS ARE MADE for modelers by a modeler. I have never met Tom Herr, but from my experience with his kits, I know I like him! Some of his personality comes through in each kit he produces. When compared with other ARF and RTF kits, Herr's are not the most complete in the industry, and they only supply a basic hardware package, but the engineering and care of assembly are unequaled. The laser-cutting is absolutely perfect, and considering the instability of balsa wood, it is unbelievable. Everything fits together like the parts in an expensive watch!

The first Herr kit I built was the rubber-powered version of the J-3 Cub. The wing was built in two pieces, and the pieces were joined to the sides of the fuselage. When I got to that step, I was truly amazed to find that the wings were true with the fuselage and the tail. This same kind of precision is evident in the RC version of the same airplane.

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

I made the first flight with the wing struts removed, and the model flew right out of my hand with only a gentle push. Landings, both on the wheels and 3-point, are smooth. When the struts are in place, it takes a little extra power to make a smooth approach and landing.

• GENERAL CHARACTERISTICS

This is a solid airplane that tracks well and has good control response. On the initial flight, only some down-trim was needed for straight and level flight, and once the trim had been established, it remained perfect at any speed. The first flight was very routine with no surprises at all. The plane's power-off glide is pretty flat. Without the struts, this is a clean airplane. Stalling at low power is easy and gentle. Overall performance is not degraded much with the additional drag of the struts added to the mix; in fact, the airplane does become a bit more Cub-like.

• AEROBATICS

A Cub is not supposed to be an aerobatic airplane, but this Cub can do things that the full-scale machine would simply find impossible. The BigMig .061 provides much more power than is needed and makes for some fun flying. Loops are round and can be small or large—your choice—and a snap at the top of a loop is easy. The airplane will snap and spin in either direction, and recovery is nearly instant. The rolls are not very axial, but they do look good. Inverted flight can be maintained with a nose-high attitude, and the plane is also capable of flying into an inverted loop. I have not tried an outside loop ... yet! Most of my flying has been with the wing struts in the flight box.

SPECIFICATIONS

Model name: Piper J-3 Cub

Type: ½A-scale sport plane

Manufacturer: Herr Engineering Corp.

Wingspan: 48 in.

Wing chord: 7 in.

Wing area: 328 sq. in.

Wing loading: 8.8 oz./sq. ft.

Overall length: 29 in.

Actual weight: 26 oz.

Radio req'd: 2- or 3-channel (rudder, elevator and optional throttle)

Radio used: FMA Direct* with 3 servos

Engine used: Norvel* BigMig .061

Retail price: $57.95

Features: laser-cut, interlocking parts; tab-and-notch construction; peel-and-stick decals; 3D CAD-designed.

Comments: this kit is easily assembled and flies with little effort. It has good looks, and with a .061 engine, the J-3 Cub will do almost any aerobatic maneuver that you can come up with.

Hits

- Laser-cutting is as good as it gets.
- Kit includes dummy engine cylinders.
- The construction sequence is logical.
- The overall engineering is topnotch.

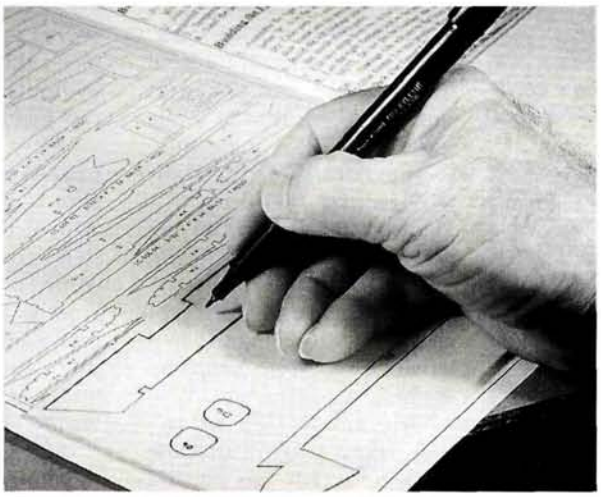
Misses

- Manual can be confusing at times.

FIRST STEPS

When you open the kit, you'll find all of the laser-cut sheets and stripwood in a clear plastic bag; the plywood parts are separate. Another clear bag holds the small parts and hardware. The plans are rolled and in two parts—the fuselage on one sheet and the wing with the stab/elevator on the other. Windshield material comes folded inside the four-page instruction manual.

The very first step in just about any laser-cut kit is to label the parts before they fall out of their carrier; you should never neglect this step.



The first step in building any kit is to label all of the parts. A felt-tip pen will not dent the balsa.

The rudder/fin and the stab/elevator are constructed first, and it takes more time to read the steps in the manual than to actually make the necessary glue joints. When the rudder and elevators had been assembled and glued, I temporarily joined the fin to the stab and sanded all of the edges round.

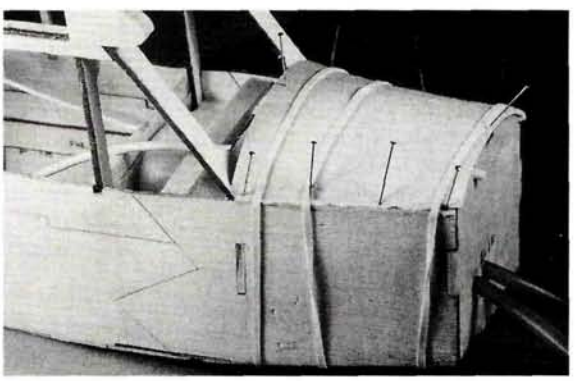
BUILDING THE FUSELAGE

The next step is to assemble the fuselage sides, which consist of several separate pieces and are assembled along with plywood doublers. The sides are labeled "L" and "R" because there is some right thrust built in to the model, and if the sides are assembled incorrectly, you will have a hard time later when you mount the firewall.

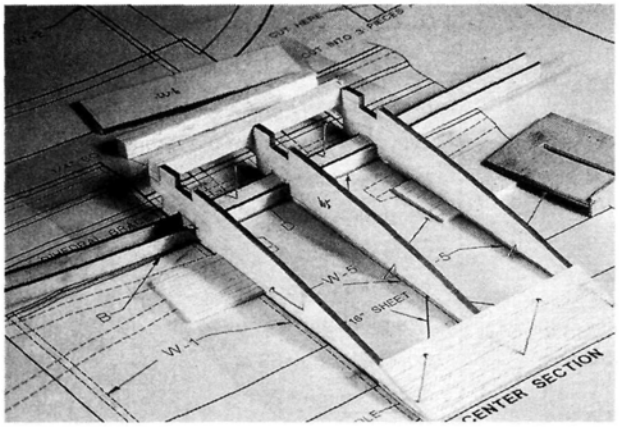
Bringing the two sides together started out nice and easy: I glued a couple of formers at right angles to one of the fuselage sides, etc., and I was able to follow the manual all the way. However, then came assembly of three different things while I was supposed to hold the fuselage sides together in my hands. This was also the time I discovered that instant glue is somewhat less than instant when you are trying to glue pieces of plywood together. I finally gave up and used good old aliphatic resin and clamps! Even though I got glue all over the airplane and myself, it was worth it because I made a solid front end for the fuselage and was able to wiggle everything together for a nice, tight fit.

I am always surprised when notches and tabs fit perfectly, especially over distances such as from the bottom of the cabin to the tail post, but that's what happened with this kit. In fact, all of the pieces fit together exactly as they should, and the fuselage came out straight and true. However, one suggestion: add cross-braces to the last former in the aft part of the fuselage (F-12), or it could split down the grain at just the wrong time.

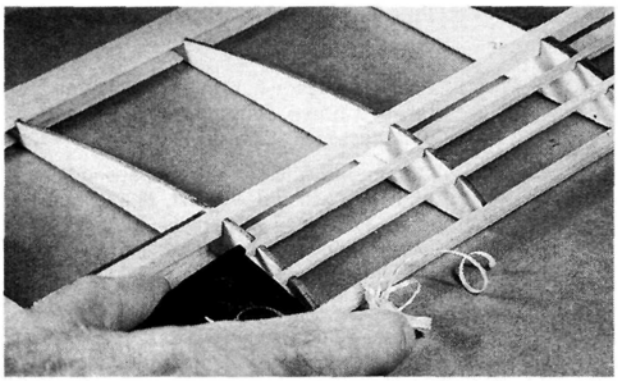
When the basic fuselage structure is finished, the instructions tell you to add the fuel tank and throttle lines before you finish the front turtle deck. This step is



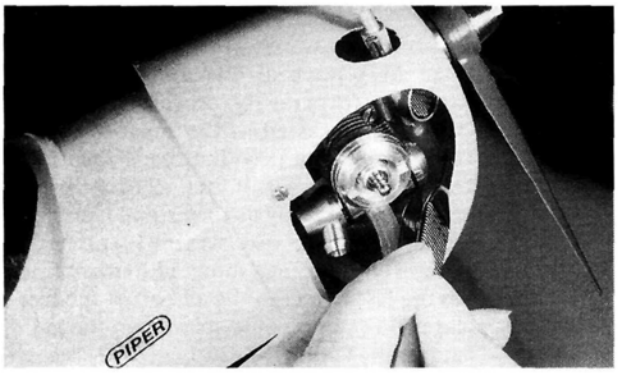
Rubber bands around the cowl sheeting work well as clamps. Aliphatic resin gives you time to make sure everything fits correctly.



First, build the center section of the wing, then build the left and right wing panels onto the center. Plywood dihedral braces set the dihedral angle and ensure a warp-free wing.



A razor plane will help you quickly shape the wing's LE. If you use transparent covering on a plane, you should always sand the laser burns from the edges of the ribs.



If you make the cowl opening large enough, you will be able to use tweezers to remove the fuel line from the carburetor. Then, you can fuel your J-3 without removing the cowl.

necessary, but the instructions also suggest that you install the servo mount and servos along with the pushrods to the control surfaces before you sand the completed fuselage. I installed a 2-ounce tank and put the mount and the pushrods in, but I did not install the servos. I didn't want to expose them to all the sanding dust that would follow.

WING CONSTRUCTION

The manual has you build the wing in three pieces that are joined as they are built. First, the center section is finished, then each wing half is joined to the center section. Since everything in the center is the same size—the leading edge (LE) and trailing edge (TE) as well as the top and bottom sheeting—I cut and sanded them all to shape at one time by matching them to the piece of laser-cut plywood that forms the front face. This simple chore ensures that everything is the same width and will really speed up assembly. You will build the four bottom dihedral braces on the bottom spar as you assemble the center section.

After the center section has been completed, join the left wing's bottom spar to the center section by the dihedral braces, and build the wing flat with the center section elevated to the dihedral angle. Once the left wing is complete, build the right wing in the same way with the whole left wing in the air. It may sound clumsy, but it's really a sensible and accurate way to build a wing—an old system coming back into practice. One thing to remember: when building the left wing, the right wing will be held higher than the dihedral called for because the angle starts at the left wing center-section joint, not the right wing center-section joint! Then lift the wing from the bench and cement the top main spar, along with its dihedral braces, to the top of all the ribs. Installing the center-section sheeting completes the basic wing structure.

One small step in the instructions suggests that the LE be "cracked" just beyond the tip rib and bent up to match the ply wingtips. I bypassed that step and trimmed the LE beyond the tip rib to conform to the "D"-shape-wingtip. Then I filled in the gap between the LE and the top of the tips with small pieces of soft balsa. Everything blended together after sanding. At this point, drill the holes in the TE for the mounting bolts and in the LE for the two 3⁄16-inch dowels that complete the wing mount. There are a few things left to do, like the fuselage/wing fairing, but for all practical purposes, the wing is finished.

FINISHING UP

I covered the whole airplane with Cub Yellow MonoKote*, and it was really a simple covering job. I always like to cover and hinge the tail surfaces before I cement them into the fuselage. I hinged them all with Z-type MonoKote hinges, which have been my favorite ever since plastic films came on the scene. I also covered the bottom wingtips first. Even though the tips are plywood and the top spars support them, I like to give them extra support while covering the rest of the wing. After epoxying the gear fairings to the wire landing gear, I also covered them with MonoKote.

For some reason, I have an aversion to tailwheels mounted on the rudder. I made a plywood bracket and mounted the tailwheel on the fuselage with a tiller that is connected to the rudder. This makes the bracket and tiller take the tailwheel load and act as buffers between the tailwheel and the rudder servo.

After making the proper cutouts for the engine in the plastic cowl, I spray painted it with Cub Yellow. It seems that everyone has a different idea of what Cub Yellow really is. The paint suggested by MonoKote was more of a lemon yellow, and the paint suggested by Black Baron* was a little on the darker side. To solve this problem, I blended the two until I came close to matching the covering. Fasten the cowl with four wood screws driven into four hardwood blocks that are epoxied to the firewall. After I had carefully trimmed the engine opening in the cowl, I was able to reach the fuel and muffler pressure lines without removing the cowl: this allowed easy fueling using only the two lines.

After I had covered the airplane, I painted the firewall along with all of the exposed wood surfaces with an epoxy cement that I thinned with acetone. This step is useful to seal any area that might come into contact with fuel or exhaust. Finally, the easiest part of the finishing process was the application of the decals that come with the kit. The aileron outlines were not included; I made them with 1⁄16-inch-wide strips of black MonoKote.

Since I had already installed the servo mounts, it was a piece of cake to reinstall the servos and slip the battery and receiver into place because everything fit! I did take a little additional weight in the nose (1½ ounces of sheet lead screwed to the firewall just below the engine) to set the balance point as shown on the plans. The plane's ready-to-fly weight was 26 ounces.

CONCLUSION

The Herr J-3 Cub is one of the best values on the market. It is inexpensive by current standards and offers a lot for the money. Construction is straightforward, and the finished product is well worth the time spent building it. The Norvel* BigMig RC .061 engine is alone in its class for value and performance. It is playing a very big part in the movement back to smaller model airplanes, and it works very well with the J-3.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✈

JUNKERS J.2

by Geoff Cozine

SPECIFICATIONS

Model: Junkers J.2 (E 252/16—the world's first all-metal fighter)

Designer: Steven Stratt

Build time: 6 months

Scale: 1/6

Wingspan: 72 in.

Wing area: 1,040 sq. in.

Weight: 6.25 lb.

Wing loading: 16 oz./sq. ft.

Power: Astro Cobalt geared 40

Batteries: 18, SR 1700mAh cells

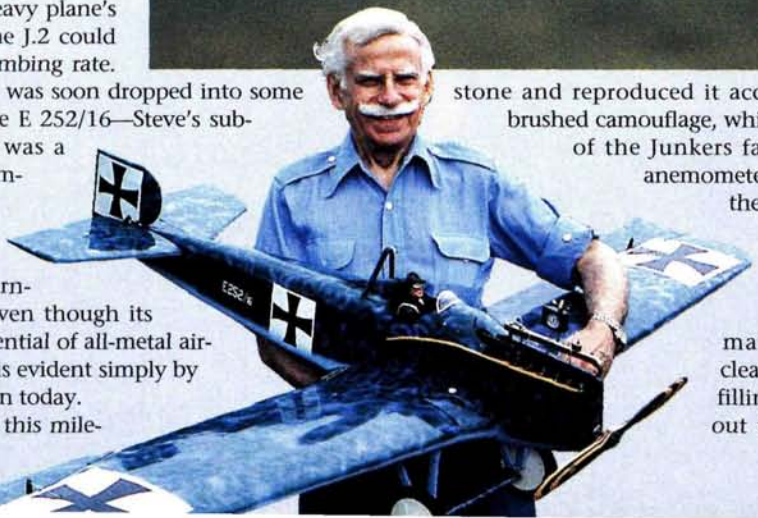
Features: bottom covered in Blue Mist MonoKote and top with Stinson Green FliteKote; airbrushed with water-based Floquil paints; Iron Crosses made with Coverite trim sheets; lettering is rub-on dry transfers; white squares sprayed on with glossy Krylon; Williams Bros. pilots and wheels—with modifications to the pilot (to age the face) and to the wheels (to replicate the canvas-over-spoke construction of the time); home-made, old-style, leather crash helmet.

Comments: this plane is said to be as tame as a trainer and it can do scale-like aerobatics, too. It offers a great combination of scale appearance and excellent flying.

Hugo Junkers, one of the world's first professors of aeronautics, is arguably one of the most important aircraft innovators of all time. The aircraft that bore his name were the scourge of the European skies during WW II, but he's probably best known for designing the world's first all-metal fighter in 1916—the J.2. Steven Stratt, former B-17 first pilot and industrial designer, owns Airdrome plans service, specializing in historically significant, museum-quality, electric-powered RC planes. He decided to model the J.2 for its clean, simple shape that lacked the corrugated outer skin of the 1918 Junkers.

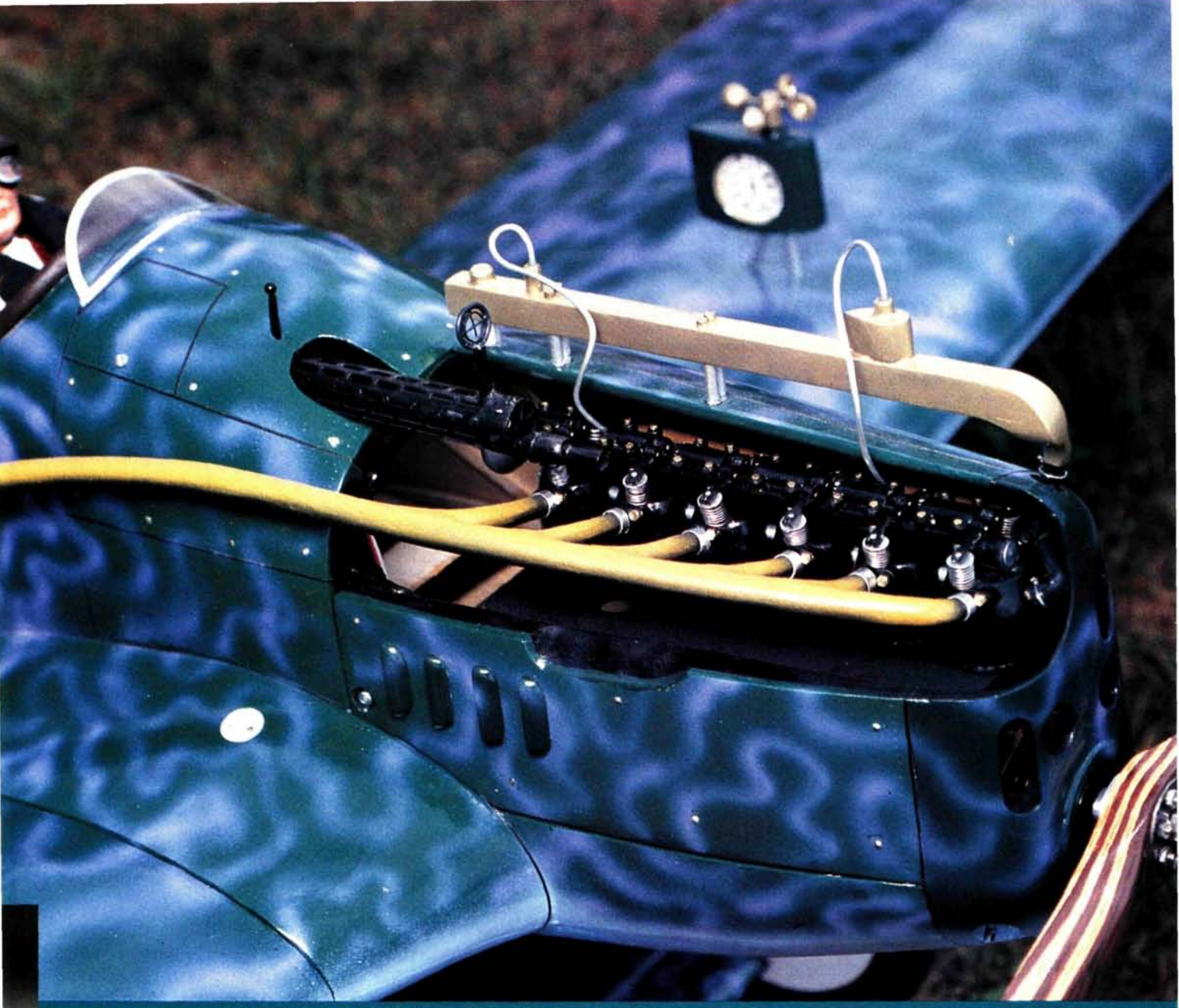
Made of ferromagnetic steel, the full-scale J.2 needed unique construction methods to make it both strong enough and light enough to fly. The cantilevered wing had internal, corrugated trusses that made it very strong without the need for the usual struts and wire riggings. Junkers originally covered the J.2 with electrically spot-welded steel—a process that Junkers perfected—that was only 0.004 to 0.008 inch thick! Through his extensive wind-tunnel experiments, Junkers realized the aerodynamic advantages of using a thick root, low wing and belly-mounted radiator, which later appeared in the WW II Messerschmitts and Spitfires.

On January 13, 1916, Junkers was given a military contract to build six of these metal monoplanes for the German government. They were each outfitted with a 120hp Mercedes D II engine. But the engine technology of the time limited the heavy plane's horsepower-to-weight ratio, so the J.2 could not meet the Army's required climbing rate. The Mercedes 160hp D III engine was soon dropped into some of these prototypes, including the E 252/16—Steve's subject. Behind the engine, there was a hump, which had been aerodynamically designed to cover a single machine gun. The new engine increased the J.2's abilities, but it didn't meet the German government's climbing requirements, even though its level speed was 124mph. The potential of all-metal aircraft was recognized, however, as is evident simply by looking at any warbird in operation today.



Steve painstakingly researched this milestone and reproduced it accurately, right down to the airbrushed camouflage, which he discovered in an old photo of the Junkers factory. He even duplicated the anemometer that the Germans mounted on the wings to act as an airspeed indicator; it spins, too. For realism, Steve used all push/pull cables, except for the ailerons.

Steve champions electric power, mainly because it's reliable and clean, but also because no mufflers, filling tubes, or cylinder heads stick out to hamper the J.2's scale looks.



He is also quick to point out that the absence of fuel residue allows the use of products such as Krylon spray paint for the large white squares and acrylic Floquil paints for the airbrushed, early Junkers, random camouflage; these products would not be advisable for engine power because fuel could destroy the finish or seep into the wood and destroy the model.

Steven put six months into designing, building and testing this prototype, and *Model Airplane News* contributor Dave Baron found that, "The Junkers flies like a good sport trainer. Takeoff rolls are approximately 50 feet, and tracking is excellent." This model doesn't just sit in its hangar! Dave even flew it at the Monmouth Model Airplane Club's WW I competition—primarily a gas event, and the pair placed first in Team Scale!

Plans for the J.2 are available through Airdrome* and the folks at Arizona Model Aircrafters* were so impressed with the design that they kitted it. Look for it at future WW I and scale meets.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✦

Microservo

38 actuators under ½ ounce

Microservos. What are they? I define a "micro" servo as one that weighs less than ½ ounce (14 grams), but for comparison, I've included a few heavier servos in this survey.

Thirty-eight servos are presented here. The summary chart includes the servo size (length x height x width in inches, excluding the output-arm projection and the mounting flanges), the total weight in both ounces and grams, the rated output in oz.-in., the transit time to make a 60-degree rotation (unless otherwise noted), the type of connectors available, the length of the cable and the price.

With a few exceptions, these servos came with several types of output arms or wheels that allow just about any kind of control hookup.

Also, essentially, all of these servos have basic connectors that can be plugged into most currently available RC receivers.

For this review, the available connectors have been grouped into four categories: the first three are the old Airtronics/Sanwa (A), JST (J) and Cannon (C); the fourth is "Standard" (S), which means the servo is compatible with Airtronics "Z," Futaba (after trimming off the end tab), Hitec, JR and other like connectors. These "standard" connectors have a positive center pin, so putting the plug in backward will not result in any damage; the servo just won't work (if it doesn't work, simply plug it in the other way).

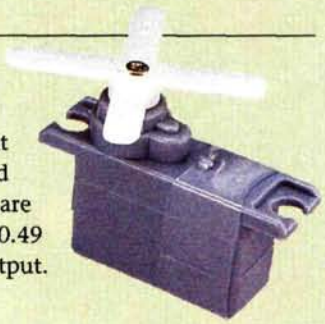
With the exception of the WES-Technik LS 2.4, which has a linear output, all of the servos use rotary output. Details of the LS 2.4 can be found in the November 1999 issue of *RC MicroFlight* newsletter or at www.rcmicroflight.com/nov99.

With few exceptions, almost all of these tiny servos have a single mounting screw on each end. Several came with brackets that permit side mounting—to mount your servo flush in a wing, for example. Probably the best way to mount these microservos is with double-sided foam tape. Remember to first coat the wood with cement or epoxy, and the tape will stick securely for a long time.

The lightest conventional, rotary-output servo in this survey weighs 0.21 ounce (6 grams), but there are already rumors that 3-gram servos with outputs of approximately 10 oz.-in. will soon be available. These will be comparable in weight to the linear-output WES-Technik LS 2.4, but even WES-Technik has plans for a lighter servo—the LS 1.8. Look for still smaller servos to come.

Ace RC Micro

At 0.35 ounce, this new microservo is well-suited to the intermediate-size parking-lot flyers that weigh between 4 and 10 ounces. The cable on this unit measures 5 inches.



FMA Direct S-60

As this is written, this is FMA Direct's smallest servo; it weighs 0.21 ounce and has an output of 10 oz.-in. and a cable length of 4½ inches. Five other microservos are available through FMA, including the S-100 at 0.49 ounce and 25 oz.-in. of output.

Airtronics Microlite

For many years, the Microlite servo (model 94501)—at 0.56 ounce—was one of the lightest available. With 29 oz.-in. of output, it is strong enough for large parking-lot models, up to and including all the Speed 400-powered, 30-ounce models. A second model (no. 94555) is available with metal gears. Neither servo has a ball-bearing-supported output shaft.

Cannon Micro Elite

Easily identified by the slight slope on the top of the case, the Micro Elite weighs just 0.35 ounce yet has a rather high output of 24 oz.-in. Cable length is 4½ inches. Another version, the Ultra Micro, has roughly the same weight and almost the same output; however, the case sizes are different.

Expert SL110

Offered by Horizon Hobby Distributors, the 110 is another entry in the smallest category at 0.21 ounce. Its output is 7 oz.-in.—better for indoor RC flying. A second version, the SL260 is only slightly larger and heavier, yet it has about twice the output. These models will soon replace the SL-200 and SL-220.

Roundup

by Bob Aberle

Determining a servo's torque

One important criterion of a servo is its output, or torque, which is usually expressed in ounce-inches (oz.-in.). If you want to check the output of a particular servo yourself, it's simple, though somewhat time-consuming: attach a small cup or container to the servo's output arm using a sling made out of a piece of string or cord. (Before you operate the servo, you'll put water in the cup to act as a weight.) To monitor servo current, wire a milliammeter between your servo and receiver. (An aileron extension cable can facilitate this hookup.)

Using transmitter input, move the servo, and note the current level on the ammeter as it moves. Keep adding water to the cup until the servo can no longer move and/or the current rises rapidly. Weigh the cup of water, and multiply its weight in ounces by the distance from the center of the servo arm to where the cup is suspended. This product will give you the rated output, or torque, in oz.-in. Obviously, this is a lengthy process; for this survey, the manufacturers' data is provided. Experience has shown me that the manufacturers' specified servo outputs are reliable figures.

Basically, a servo's output rating helps you determine the size of servo you need for a particular model:

- Larger parking-lot models (10 to 16 ounces) require at least 10 oz.-in., and 12 to 14 oz.-in. would be even better.
- Smaller parking-lot models (4 to 10 ounces) require 8 to 10 oz.-in.
- Indoor RC models (4 ounces or less) can use servo outputs of 8 oz.-in. and less. Because of the slow flying characteristics of these models, you'd be surprised about how little servo output they really need.

Balsa Products BP-101

This is actually a GWS (Grand Wing Servo) Pico BB. These servos will also soon be sold by Sky Hooks & Rigging under a different model number. Also one of the lightest conventional servos at 0.21 ounce, it has a cable that's only 4½ inches long, but a good selection of output arms is provided. Three other microservos are available from Balsa Products, all less than ½ ounce in weight.

Cirrus CS-10 BB

This ball-bearing microservo weighs in at 0.21-ounce. Output is rated at 7 oz.-in., and this makes it better suited to indoor RC flying. At 4½ inches, its cable length is short, but Cirrus has four other microservos that range up to a ½-ounce unit with a 25 oz.-in. output (very strong!). All five of these servos have ball-bearing-supported output shafts.

Futaba S3103

A new entry in the micro world, it has an output of 17.3 oz.-in. and weighs 0.28 ounce (8 grams). This is a strong servo that is also light, and it's well-suited to anything from indoor to the larger, parking-lot-size models.

Helpful hints

A major concern of micro fliers is that the linkages and hinges used between these tiny servos and the control surfaces move as freely as is possible without binding. With so little servo output available, any extra resistance in the linkage or hinges could stall the servo and/or prompt excessive current drain. To eliminate the chance of linkage binding, install the servo near the control surface, even if you'll need a long extension cable between the servo and the receiver to do so.

A good way to check a servo's control hookup is, once again, to use a milliammeter with the help of an aileron extension cable. Disconnect the control linkage from the servo, then operate the servo and measure the current drain without any load. Then reconnect the linkage and operate the servo again. If there is a significant increase in current drain, it is due to control-linkage or hinge binding. If this happens, correct the situation before you fly your model. Having a "U"-shaped or warped elevator is a common problem that can cause binding and prevent the elevator from returning to a neutral position.

A final concern with these tiny servos is placing excessive loads on the gear trains. One solution is to make sure that your control surfaces don't touch the ground. Ailerons can be protected by adding tip plates; rudders can be protected by adding a tail skid or a skeg. By doing this, you'll prevent shock loads on the control surfaces from being transferred to the servo gears.

Microservo Roundup

Maxx Products (MPI) MX-30 BB

With a very nominal weight of 0.21 ounce, the MX-30 BB has a ball-bearing-supported output shaft, but the cable is only 4 inches long. Both the MX-30 and MX-32 are available with a JST (European) connector. The MX-50 servo comes with or without ball bearings.

Hitec RCD HS-50

Hitec's popular Feather sub-microservo is one of the lightest conventional, rotary-output servos at 0.21 ounce (6 grams). Now, it's available with a larger output arm, and this makes control-linkage installation more convenient. However, at 3 inches, the cable length is very short. A new and slightly larger version of this servo (HS-55) will soon be available.

Hobbico CS-15

This sub-microservo weighs ½ ounce and has a 15 oz.-in. output and a relatively fast transit time. It comes with side-mounting brackets for easy wing mounting.

Volz Kolibri and Twins

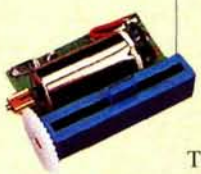
Volz microservos are available from RC Direct, among other select outlets. The Kolibri weighs 0.28 ounce and has 11 oz.-in. of torque. Mounting this servo is quite different. It is essentially a molded-plastic bucket, which makes it ideal for flush mounting on the side of a fuselage. A second version called the Twins includes two of the Kolibris inside one larger bucket. Each Volz servo comes with a short cable that terminates in a JST connector, but you can buy adapter cables that convert the JST-type to the "standard" end. These adapter cables are available in lengths of 12, 20, 32, 39 and 59 inches.

JR-241

JR's sub micro-servo (0.28 ounce) is lightweight and has a fast transit time. Its cable length is a generous 6 inches, and it's a perfect companion for the new JR micro receiver.

Tower Hobbies TS-15

This one is approximately ½ ounce as well. The cable length is somewhat short at 4½ inches, but it, too, comes with side-mounting brackets for wing mounting.



WES-Technik LS 2.4

This linear output microservo is, by far, the lightest unit at just 0.10 ounce (less than 3 grams). Basically, linear output means its motion is push/pull rather than rotary. The LS 2.4 only has about 6 oz.-in. of torque, so it is intended for only the very smallest of indoor models. It comes with a JST connector on the end of a very short, 3½-inch cable. The slightly more robust LS 3.0 will soon be available from Todd's Models. Next year, an even lighter servo will be added: the LS 1.8. These tiny servos have no mounting flanges, but Todd Long recommends cementing a small wooden strip on one side and then cementing that strip to your model (there is little area available to effectively use double-side tape). See a detailed evaluation of this servo in the November '99 issue of *RC MicroFlight* newsletter, or log on to www.rcmicroflight.com/Nov.99.

MANUFACTURER AND MODEL	Size (in.)	Weight (oz./g.)	Output (oz.-in.)	Transit time for 60º (sec.)	Available connectors*	Cable length (in.)	List price**
Ace Micro (8112)	7/8x15/16x7/16	0.35/10	11	0.11	S, A	5	$31.41
Airtronics Microlite (94501)	1 1/16x1 1/16x1/2	0.56/16	29	0.23	S, A	5	$79.95
Airtronics Microlite with metal gears (94555)	1 1/16x1 1/16x1/2	0.63/18	30	0.21	S, A	7	$119.95
Cannon Micro Elite	1x1 1/8x1/2	0.35/10	24	0.4 (for 100º)	C	4 1/2	$54.95
Cannon Ultra Micro	7/8x1 3/16x7/16	0.35/10	20	0.4 (for 100º)	C	3 1/2	$59.95
Cirrus CS-10 BB Molecular Micro	7/8x7/8x3/8	0.21/6	7	0.09	S, A	4 1/2	$44.95
Cirrus CS-20 BB Sub Micro	1x15/16x7/16	0.35/10	11	0.11	S, A	5 1/2	$39.95
Cirrus CS-21 BB HP Sub Micro	7/8x15/16x7/16	0.35/10	19	0.09	S, A	5	$47.95
Cirrus CS-25 BB Pro Sub Micro	1x1x1/2	0.49/14	22	0.12	S, A	5	$42.95
Cirrus CS-26 BB Max Sub Micro	1x1 1/8x1/2	0.49/14	25	0.15	S, A	5 1/2	$44.95
Expert SL-110 (replaces the SL-200)	3/4x7/8x7/16	0.21/6	7	0.08	S	3	$34.95
Expert SL-260 (replaces the SL-220)	3/4x7/8x7/16	0.32/9	15.4	0.21	S	4	$27.95
FMA Direct S-100 Micro BB	1 1/16x1 1/8x7/16	0.49/14	25	0.15	S, A	6	$31.95
FMA Direct S-60	7/8x7/8x3/8	0.21/6	10	0.12	S, A	4 1/2	$29.95
FMA Direct S-70 Super Sub Micro BB	7/8x1x3/8	0.21/6	11	0.12	S, A	4 1/2	$29.95
FMA Direct S-80 Sub Micro BB	7/8x15/16x7/16	0.35/10	11	0.11	S, A	6	$31.95
FMA Direct S-90 Sub Micro BB	7/8x15/16x7/16	0.35/10	19	0.09	S, A	6	$24.95
Futaba S3103 Microservo	13/16x15/16x7/16	0.28/8	17.3	0.11	S	6	$69.95
GWS Naro BB (Balsa Products BP-103)	13/16x15/16x7/16	0.35/10	11	0.11	S	5	$19.00
GWS Naro HP/BB (Balsa Products BP-105)	7/8x15/16x7/16	0.35/10	19	0.09	S	5 1/2	$21.00
GWS Naro Max/BB (Balsa Products BP-107)	1 1/16x1 1/8x7/16	0.49/14	25	0.15	S	5	$19.00
GWS Pico BB (Balsa Products BP-101)	7/8x7/8x3/8	0.21/6	10	0.12	S	4 1/2	$24.00
Hitec RCD HS-50 Feather	13/16x7/8x7/16	0.21/6	8.4	0.09	S, A	3	$58.95
Hitec RCD HS-55	15/16x1x1/2	0.28/8	16	0.16	S, A	6	$39.95
Hitec RCD HS-60	1x15/16x1/2	0.49/14	18.2	0.16	S, A	6	$49.95
Hobbico CS-15 Sub Micro	1x15/16x1/2	0.49/14	15	0.20	A	6	$44.99
JR 241 Super Micro	13/16x13/16x7/16	0.28/8	17	0.23	A	6	$34.95
Maxx Products Inc. MX-30 BB	7/8x7/8x3/8	0.21/6	11	0.09	S, A, J	4	$29.99
Maxx Products Inc. MX-32 BB	7/8x13/16x3/8	0.21/6	8	0.07	S, A, J	4	$29.99
Maxx Products Inc. MX-50	7/8x15/16x7/16	0.35/10	14	0.09	S, A	5	$20.99
Maxx Products Inc. MX-50 HP BB	7/8x15/16x7/16	0.35/10	23	0.078	S, A	5 1/2	$24.99
Tower Hobbies TS-15 Sub Micro	1x15/16x1/2	0.49/14	15	0.20	S	4 1/2	$59.99
Volz Kolibri	1 1/8x1 1/8x1/2	0.28/8	11	0.15 (for 40º)	S, A, J	1 3/4	$35.99
Volz Micro Maxx	1 1/8x1 3/16x1/2	0.7/20	47	0.12 (for 40º)	S, A, J	1 3/4	$59.99
Volz Micro Star 3	1 1/8x1 3/16x1/2	0.7/20	42	0.10 (for 40º)	S, A, J	1 3/4	$52.99
Volz Twins (2 Kolibris in 1 case—2 functions)	1 1/8x1 1/8x7/8	0.56/16	11 (each)	0.15 (for 40º each)	S, A, J	1 3/4 (2)	$68.99
Volz Zip	1 1/8x1 3/16x7/16	0.42/12	19.5	0.12 (for 40º)	S, A, J	1 3/4	$34.99
WES-Technik LS 2.4	13/16x9/16x3/8	0.10/3	6.2	0.20 (for 12mm)	J	3 1/2	$65.00

* For the purposes of this review, "Standard" (S) means that the servo is available with the center-positive-pin connectors (i.e., Airtronics "Z," Futaba, Hitec, JR, etc.). Availability of JST (J), old Airtronics/Sanwa (A) and Cannon (C) connectors is also noted.

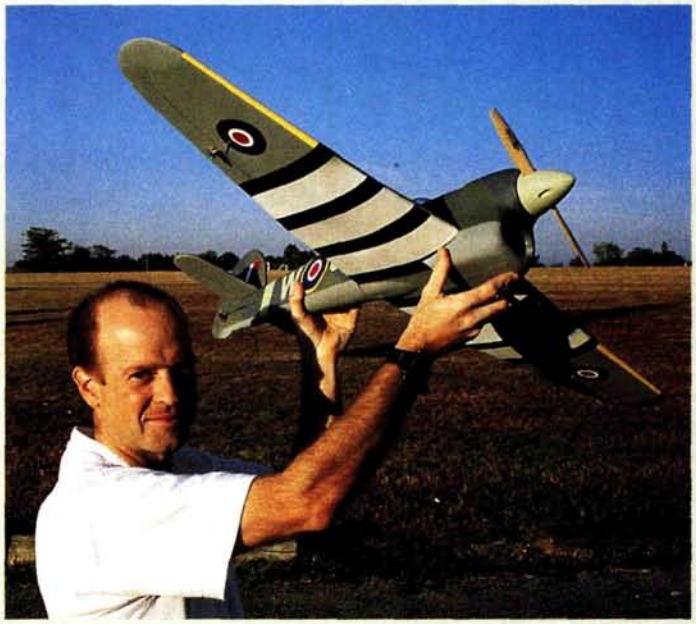
** These are manufacturers' list prices, which are often significantly higher than street prices. Visit your local hobby shop for more information.

The addresses of the manufacturers featured in this guide are listed alphabetically in the Index of Manufacturers on page 150. +

A sport-scale, WW II electric or glow kit

HOBBY HANGAR

HAWKER TYPHOON



PHOTOS BY JOHN VAGO

by John Vago

THE BRITISH AIR MINISTRY BEGAN designing the Hawker Typhoon in 1937 as a potential replacement for the Hawker Hurricane. The initial prototype (Mk IA) suffered from structural failures of the fuselage as well as powerplant development difficulties. The second prototype (Mk IB) was first flown in May 1941 with the wing now housing four 20mm cannons. This cantilever, low-wing aircraft ultimately found its niche as a high-speed, low-level interceptor. Following V-E Day, few remained in service because they were being replaced by the Hawker Tempest.

This 1/12-scale Hawker Typhoon Mk IB kit was drawn and designed by Ron Daniels and is distributed by Hobby Hangar*. The kit is marketed to accommodate either glow (.15 to . 25) or electric power. Because I am a new electrics enthusiast, I opted to build this aircraft electric using an AstroFlight* 605 geared cobalt motor for power.

SPECIFICATIONS

Manufacturer: Hobby Hangar

Type: 1/12-scale, sport WW II warbird

Wingspan: 41.5 in.

Length: 32 in.

Wing area: 275 sq. in.

Weight (with nine 800mAh AR cells): 43 oz.

Wing loading: 22.5 oz./sq. ft.

Airfoil: semisymmetrical

Radio req'd: 4-channel with 2 to 3 servos

Radio used: JR* 8103 with 3 Hitec* HS-80 servos

Motor used: AstroFlight 605G

List price: $64.99

Features: laser-cut parts, symmetrical wing, 2-piece ABS-molded cowl, clear canopy, wing fillets, landing gear (fixed), control horns, bellcranks, rolled plans.

Comments: this is a nice, sport-scale warbird for intermediate and experienced builders.

Hits

- High-quality balsa.
- Laser-cut parts.
- Strong, lightweight airframe.

Misses

- Plans could use more detailing.
- Cowl is difficult to assemble.
- Provided bellcranks were binding excessively.

Editor's note: an optional one-piece cowl is now available from Hobby Hangar.

THE KIT

When you open the box, all the balsa and hardware parts are neatly bundled or bagged in a logical order. The balsa parts appeared to be lightweight and of excellent quality, adding to my confidence that the stock configuration would yield a relatively light airframe. All of the balsa and ply parts are laser-cut, with small tabs remaining to secure each part to its parent sheet. The individual parts and sheets have identification codes burned into them, and a sheet is provided with the plans, which further aids in their identification. In my opinion, however, this kit is not for the novice builder. The introduction to the instructions indicates that this model can be framed up in as few as 10 hours. As a relatively experienced builder, I found this estimate to be somewhat optimistic, as it took me nearly 20 hours to assemble my Typhoon.

BUILDING THE TAIL GROUP

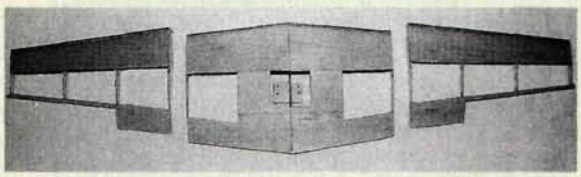
Construction begins with the assembly of the rudder and stabilizer, which are removed from the 1/4-inch sheet by cutting through the small balsa tabs. Multiple holes have been laser-cut into the pieces to make them lighter, and the wood must be removed. I found many of these holes to be incompletely burned through, making it difficult to remove them without damaging the precut parts.

At this point, use the prebent elevator-joiner wire to connect the right and left elevator halves. When the wire has been epoxied into place, reinforce the joints with 1 1/2- to 2-ounces-per-square-yard glass cloth (not supplied) using thin CA. Next, properly position the fin, and tack-glue it into place on the stabilizer. Using the precut, 1/8-inch locating holes in the stabilizer, drill two holes up into the bottom of the fin. Then, remove the fin, and glue 3/4-inch lengths of 1/8-inch-diameter dowel into the stabilizer holes. This is a nice setup that helps you attach the tail group to the fuselage later in the building process. At this point, the instructions refer the builder to step FT1 in the fuselage construction section. This step deals with the final assembly of the tail group and the fillet making. I opted to postpone this step until I had the fuselage framed up.

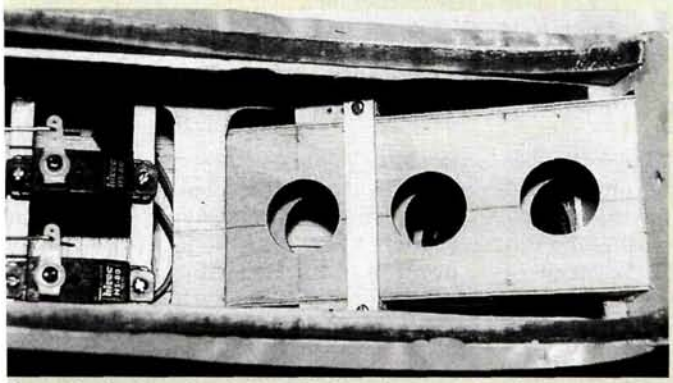
WING CONSTRUCTION

You build the wing in three separate sections (center, right and left panels) over wax-paper-covered plans. The ribs have jig tabs to keep the wing true during construction and to provide the appropriate amount of washout in the outer wing panels. Provisions are made to include a fixed landing gear, but the gear may be omitted for a hand-launched model, which is what I preferred. In the construction of the leading edge of the wing, the instruction booklet refers to pieces SUB-1 and SUB-2. This generated some confusion for me, as the pieces are not called this on the plans. Ultimately, I realized that the slots cut in the front of each rib are made to accommodate 1/16x1/4-inch pieces of balsa, which are referred to as SUB-1 and SUB-2. *Editor's note: Hobby Hangar has since updated the manual to lessen confusion.*

The ailerons are operated by a set of bellcranks in the outer wing panels. I felt that the supplied bellcranks were binding excessively, so I replaced them with a set of Du-Bro* bellcranks. The rest of the wing assembly is relatively straightforward. The ailerons are precut out of 1/4-inch balsa stock, again with holes to save weight. The ailerons do require a modest amount of planing and sanding to get them to conform to the shape of the airfoil. If you were careful to keep the jig tabs in contact with the building board, the wing will be warp-free, lightweight and have good torsional rigidity after you epoxy the completed outer wing panels to the center section. The aileron servo is installed into the



The three wing panels are ready for assembly. The wing assembly is straightforward and uses laser-cut ribs with jig tabs to create a strong, lightweight airframe. A significant amount of washout is built into the outer wing panels.



Here, the battery box is installed in the fuselage. Secure the lite-ply strap to the fuselage sides and reinforce it with triangle stock. Place two screws through the strap and into the hardwood rails. By placing several holes in the side rails, you can move the battery box to properly balance the airplane. A hole in the firewall allows the box to fit through.

FLIGHT PERFORMANCE

by Jim Ryan

To power the model, we used a geared Astro Cobalt 05 and nine 800mAh cells; this is the most cells that can be used safely with the BEC speed control. This gave the model an all-up weight of 43 ounces. I set up the control throws and CG following the instructions, and John installed the battery on a sliding ramp so that the pack could be inserted through the big chin scoop. One great thing about an electric model is that even with an extraordinarily short-nose moment like the Typhoon's, the battery can be positioned so that no ballast is needed. After final radio checks, it was time to fly.

• TAKEOFF AND LANDING

For the initial flights, I used a 10x7 Zinger* prop, and while the hand-launch was easy enough, the Typhoon needed to be flown constantly at nearly full power; it was just a little too slow. Confident of the plane's handling characteristics, we tried a 10x8 APC* prop. What a difference! Acceleration after launch was much better, and it was noticeably faster.

With the light wing loading, the launch poses no problems at all. The Typhoon accelerates straight away and climbs with authority. Landings are equally stress-free. With the thick airfoil, the Typhoon slows right down on final, and it can be held off for a very slow belly-landing. With the small 800mAh AR cells, the flight duration is around 4 minutes, and given the pleasant handling of the lightweight setup, we think this is fine.

• HIGH-SPEED PERFORMANCE

With 9 cells and the 10x8 APC prop, top speed is just over 50mph, and the Typhoon looks very realistic for a compact warbird. Handling at high speed is solid and predictable. With the short nose moment, the warbird is very responsive to pitch inputs.

• LOW-SPEED PERFORMANCE

With the present power system, the Typhoon needs about ⅔ throttle for normal flight performance, but it can stooge along very slowly if you pull the power back during level flight. The stall is extremely gentle, with the nose simply mushing downward. Stall recovery is a simple matter of reducing backpressure on the stick and smoothly adding power.

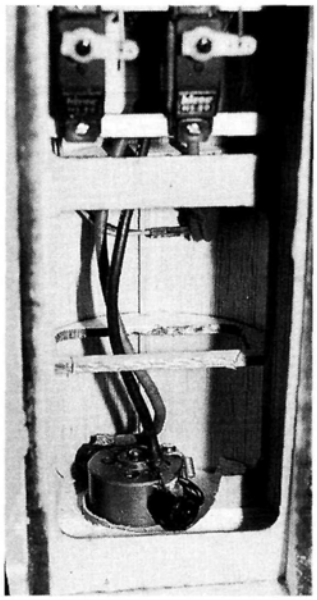
• AEROBATICS

Once we changed to the 10x8 prop, this model became very enjoyable. Loops are big and round, and with a little power management, speed is uniform throughout these maneuvers. The roll rate with the recommended control throws is solid but not too fast. We were really impressed with the inverted performance; just roll the Typhoon on its back, and you can cruise around inverted with just the slightest application of down-elevator.

center wing section. A side view of rib W-1 is not provided on the plans and would be helpful to the builder during this step.

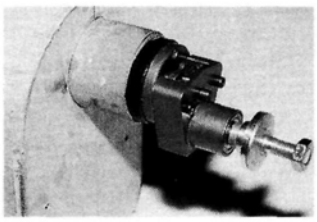
BUILDING THE FUSELAGE

The first step in constructing the fuselage is complete when you mount the powerplant to the firewall. The plans show the firewall (TY) with centerlines drawn for geared electric-motor and glow-engine placement. The length of the AstroFlight 605G I decided to use necessitated recessing the motor in the firewall. After removing the gearbox, I wrapped two layers of 1/64-inch ply around the motor's case and then glued these layers together to create a motor-mount tube. The next step requires careful thought, as a hole must be drilled into the firewall to receive this tube. With the gearbox reattached to the motor, I calculated where the hole should be placed so that the spinner plate would be centered on the cowl (as indicated on the plans).



The inside of the radio compartment. Note that the motor is recessed in the firewall so it fits under the cowl.

After installing the tube, construction continues by building a basic fuselage box that is reinforced with triangle stock and to which you'll add the upper and lower formers. The entire fuselage is ultimately sheeted with 1/16 balsa. The firewall is mounted to the fuselage using the predrilled locating holes. This makes proper alignment of the firewall a snap. The cowl is molded out of two pieces of ABS plastic that require extensive trimming and sanding to fit to the fuselage correctly. Since I intended to belly-land this airplane, I reinforced the inside of the cowl with 1/64-inch strips of ply along the seams and 1-ounce glass cloth inside the entire cowl. The instructions recommend attaching the cowl to the fuselage by epoxying a series of hardwood blocks (not supplied) to the firewall. To save a little weight, I glued four, 1/4x1/4x1/16-inch squares of lite-ply, which I evenly placed flush across the fuselage sheeting. Secure the cowl to these plates with small metal screws.



I used two layers of 1/64-inch ply to make a tube to take the AstroFlight 605G motor and gearbox, which I mounted so that the spinner plate will be centered on the cowl.

FINISHING UP

I covered the airplane wing and tail surfaces with Coverite* Micafilm and glassed the fuselage with .55-ounce cloth. After priming, I airbrushed the plane with Floquil military paints. Because the nose moment on the Typhoon is relatively short, I needed to place the battery pack as far forward as possible to balance the plane. I decided to build a 2 1/8x7/8x5 7/8-inch battery box out of 1/16-inch lite-ply. I then cut a hole in the firewall below the motor mount and slid the battery box up inside the fuselage and extended it in front of the firewall. A "strap" of lite-ply, glued to each side of the fuselage and reinforced with 1/4-inch triangle stock, secures the box. Gluing 1/4x1/4-inch hardwood rails to each side of the battery box permits you to move the box forward or aft to balance the model.

I set up the control throws as the instruction manual recommended and placed the CG about 1/4 inch forward of the main spar for the initial flight. The final weight was 43 ounces with a 9-cell 800mAh AR battery pack. After installing the AstroFlight 215D ESC, my friend Jim Ryan agreed to put the Typhoon through its paces on the first few flights.

CONCLUSIONS

The Hobby Hangar Hawker Typhoon is a great 1/12-scale sport kit for the intermediate builder who's looking for a warbird. The kit also comes with parts to dress up the plane as well as suggestions for adding wing guns and exhaust stacks. For those interested in making their own roundels and squadron markings, Ron Daniels has a .dxf file available on his homepage to help you along (http://members.aol.com/rwdrc). In addition to the Typhoon kit, Hobby Hangar also offers a 1/12-scale Hawker Tempest Mk V, Tempest Mk II and Sea Fury models. All these Hobby Hangar Hawker kits are reported to use similar construction techniques.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

HITEC RCD

Flash 5X

by Bob Aberle

Versatility on a budget

About five years ago, I reviewed the then new Hitec RCD* Flash 5 RC System. I'm still using that system today, so it is safe to say I really like it. At the time, the Flash 5 was a major step up in the computer radio market, yet it was offered at a very attractive price.

Hitec RCD has now updated its Flash 4 and 5 systems to a new System X version. Two noteworthy additions to this system are a 5-model memory and an automatic "save" feature for all input commands. Although both the Flash 4 and 5 have been updated, I will focus on the Flash 5X (5-channel version).

The new Flash 5X transmitter is outwardly similar to the previous model; however, inside the case you now have 5-model memory, and auto-save feature for stored control inputs and an easy way to store digital trims.

PHOTOS BY WALTER SIDAS AND BOB ABERLE

The new Flash 5X also has a better way to handle the digital trim. With the original Flash 5, it was difficult to know how far from center each of your trims was. With the 5X, you can press a trim button at any time to easily trim your model, as you did on the Flash 5; but now, the instant you press that trim button, the LCD screen displays the percentage of deviation from the neutral position. Let's say you needed 20 percent down-elevator trim to neutralize the climbing tendency of your model. When you set a particular channel, it is automatically stored in the transmitter's memory. If you want to know how much trim you're using, simply press the trim button; the number pops up for a few seconds, after which the normal display reappears. This can make life easier for you at the field.

Because the trims are digital, it is difficult to move a throttle-trim lever down quickly to kill your glow engine at the end of a flight. To handle this, Hitec recommends that you set up the throttle in the high-trim position. After landing, press the "cut-save" key, and the throttle will close the rest of the way, thereby shutting down your engine completely.

There are a few more subtle improvements in the new System X. The older system had a single "acro" mode to cover most general fixed-wing-flying chores. The new system has this basic "acro" mode and two others as well: "glid" and "glidacro." These modes provide some very specialized control options, such as V-tail, elevons, spoilers, spoilerons (spoilers and ailerons working together) and even flaps and flaperons (flaps and ailerons operating together). All of these control

If you want to know how much rudder trim is being used, simply press the rudder-trim switch. In this instance, the LCD screen shows "6%," meaning that 6 percent of the rudder trim is being applied. Within a few seconds, this reading disappears, and the default display returns.

options are generated at the transmitter end and, again, are saved automatically.

The instruction manual supplied with this system is a greatly expanded version of the one that was used in the past. It's very professional and very thorough, but you will have to spend some time reading it and actually playing with the controls to fully learn all of the available features. Be assured, though, that if you take the time to read the manual, the Flash 5X holds a world of possibilities.

The Flash 5X has many options for each of its five model memories, and these are easy to set and adjust. As I mentioned earlier, you can choose from three flight modes, but you can also set the mode of your transmitter (mode I or II) as well as select elevon or V-tail mixing (one or the other, but not both at the same time). A reset function allows you to return everything to the factory default settings. You can scroll to items such as endpoint adjustment, aileron/rudder mixing, servo reversing, dual-rate control for elevator and aileron and exponential rate control for elevator, aileron and rudder.

SPECIFICATIONS

Model: Flash 5X System

Manufacturer: Hitec RCD

Type: 5-channel, 5-model-memory computer radio available on all 72MHz, RC-aircraft channels with FM modulation (low side); compatible with both Futaba and Ace RC systems.

Transmitter: 28.3-ounce, dual stick (Mode II or I selectable) radio with three modes for fixed-wing aircraft, electric sailplanes and conventional sailplanes. The RF module is built into the case and is not removable. The charging jack has a blocking diode, so you'll need to remove the battery to cycle or test it.

Receiver: 0.8-ounce, PPM/FM, dual-conversion Supreme Super Slim. It is ultra narrowband and has 8 channels. Hitec standard connectors easily fit other brands; the center pin is positive. (The 5-channel 555 receiver comes in the micro package and weighs 0.75 ounce.)

Servos: four, 1.6-ounce HS-422 non-ball-bearing servos. They put out 43 oz.-in. of torque and have a transit time of 0.21 seconds for a 60-degree rotation. Hitec connectors are pre-installed. (In the micro system, there are three, 0.6-ounce HS-81 servos that put out 32 oz.-in. of torque and have a transit time of .11 seconds for a 60-degree rotation.)

Accessories: Switch harness, 4-cell, 600mAh Ni-Cd battery pack with heat-shrink wrap (micro system: 270mAh Ni-Cd pack), dual-output battery charger, aileron extension cable, servo-mounting hardware, extra output arms, frequency flags and an instruction manual.

Total airborne system weight: 10.9 ounces (receiver, four servos, switch harness, battery and aileron extension cable)

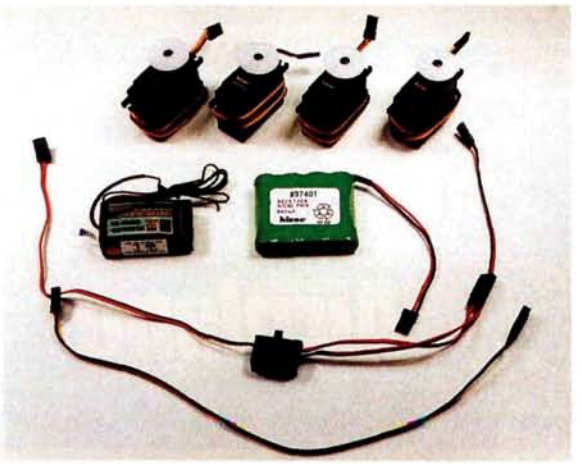
Street price: $185 (micro system: $199)

Features: the Hitec Flash 5X system has been upgraded from a 2- to a 5-model memory. All input commands are automatically saved when you move on to the next menu item. The Flash 5X is geared to fixed-wing aircraft fliers but has additional features for the sailplane enthusiast. It employs digital trim, and the position of the trim is easily read on the LCD screen by simply pressing the trim button. Engine cutoff for glow-engine applications is available by pressing a selected button. An audio low-voltage alarm tells you when it is time to charge the transmitter battery pack.

Comments: this is an excellent beginner or sport-flier radio that is also capable of competition performance. It provides a good introduction to a computer-controlled radio system. It's very simple to operate, and 5-model memory allows the operation of up to five airborne packs off a single transmitter.

Hits
- Easy to learn how to operate basic and intermediate functions.
- Very low price.
- Digital trim is easy to work with.

Misses
- Instruction manual is a little overpowering.
- Will take patience to understand some of the advanced systems operation and menu routines.



The complete Hitec RCD Flash 5X RC System without the transmitter. The Supreme Super Slim receiver, the HS-422 servos and the 600mAh battery pack are included. The total airborne weight of the system (except for the transmitter) is a mere 10.9 ounces.

An interesting feature of the Flash 5X is that two of its trim buttons (CH-4 [rudder] and CH-1 [aileron]) double as control-input buttons, and this saves two extra switches on the front panel. Some might find this confusing at first, so study the manual carefully.

Along the top of the transmitter case are a series of four mini toggle switches—two on each side of the antenna mast. The functions of these switches, including dual rates and exponential, can vary depending on which flight mode you select. A chart in the manual explains this in detail. One can be used as a training switch. With a suitable cable, you can link up to another Hitec transmitter for training purposes. Two of these switches have three positions and can provide flap control, retracts, flaperons, camber control or even operate auxiliary devices.

Another neat feature is a low-battery alarm that sounds when the transmitter voltage falls below a preset minimum level. The LCD screen also always displays

A blocking diode prevents battery voltage from going beyond the charging jack. To test or cycle the battery, you need to physically remove the pack—an easy job. These are 600mAh cells; you can fit up to 1400mAh NiMH cells in place of them.

The Super Slim receiver's clear markings make it obvious that it is for aircraft, not surface, use (that means no cars or boats!).

the battery voltage. However, the radio doesn't give you an indication of how much RF energy is going to the antenna, so a small, clip-on RF detector might prove a worthwhile accessory. For those who normally use battery testers or cyclers, a blocking diode makes voltage unavailable at the charging jack. The pack itself is easily accessed via a rear compartment cover, and it has its own connector, so it's easy to remove and test the pack outside the transmitter.

The Flash 5X includes an 8-channel Hitec Supreme Super Slim dual conversion FM receiver that weighed 0.8 ounce on my digital scale. This could probably be reduced by 0.2 ounce if you removed the case and substituted a piece of heat-shrink tubing. With the case, the receiver is 1⅞ inches long, 1 1/16 inches wide and ⅝ inch thick, and the connectors plug in at the end. Four HS-422 servos that each weigh 1.6 ounces are also included. The 600mAh, 4-cell battery pack weighs 3.2 ounces. The total airborne pack with four servos, switch harness and aileron extension cable weighs 10.9 ounces. *[Editor's note: a micro package is available with three HS-81 servos, a 270mAh battery and the 555 micro receiver.]*

As I mentioned earlier, there is also a Flash 4X RC system; it has one less channel function. It comes with a Supreme receiver that weighs 1.34 ounces.

The new features and affordable price of the Hitec RCD Flash 5X RC system make it a very attractive package for any sport or serious RC flier. Add to these its solid, reliable performance, and you have a winning radio system.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

A classic ⅓-scale aerobatic biplane

Bücker Bü-133 Jungmeister

by Gary Allen

With two wings and a round engine, the Bücker Bü-133 Jungmeister, designed as an advanced aerobatic single-seat trainer, is truly the epitome of an aerobatic biplane. This masterpiece of Carl Bücker's German company, Bücker Flügzeugbau GmbH, rolled out of the factory in early 1935, two years after the introduction of the company's highly successful two-seat biplane trainer, the Bü-131 Jungmann.

The design of these legendary aircraft resulted from Bücker's collaboration with his brilliant young Swedish engineer, Anders J. Andersson. The two aircraft were very similar in design and construction, and they shared many jigs and components. Both aircraft were commercially successful and certainly provided a major inspiration for Curtis Pitts' design of the Pitts Special.

The only intended deviation from scale in my design is the wing airfoil. I elected to use a semisymmetrical section rather than the scale, flat-bottom section. All other outlines and sections are intended to be exact scale.

My design features standard balsa and aircraft ply construction and uses standard hobby shop and hardware store items. All the fittings are fabricated by hand from brass sheets. The cabane struts are fashioned from hardware store aluminum, and the interplane struts from hobby shop streamlined tubes. I actually built two identical models simultaneously. One is intended for fun scale and is relatively undetailed; the other is covered with fabric, painted and fully detailed. The fun scale version weighs 21 pounds, and the fully detailed version weighs an additional 9 ounces.

SPECIFICATIONS

Model: Bücker Bü-133 Jungmeister

Type: ⅓-scale aerobatic biplane

Wingspan: 86½ in.

Length: 77½ in.

Weight: 23 lb.

Wing area: 2,086 sq. in.

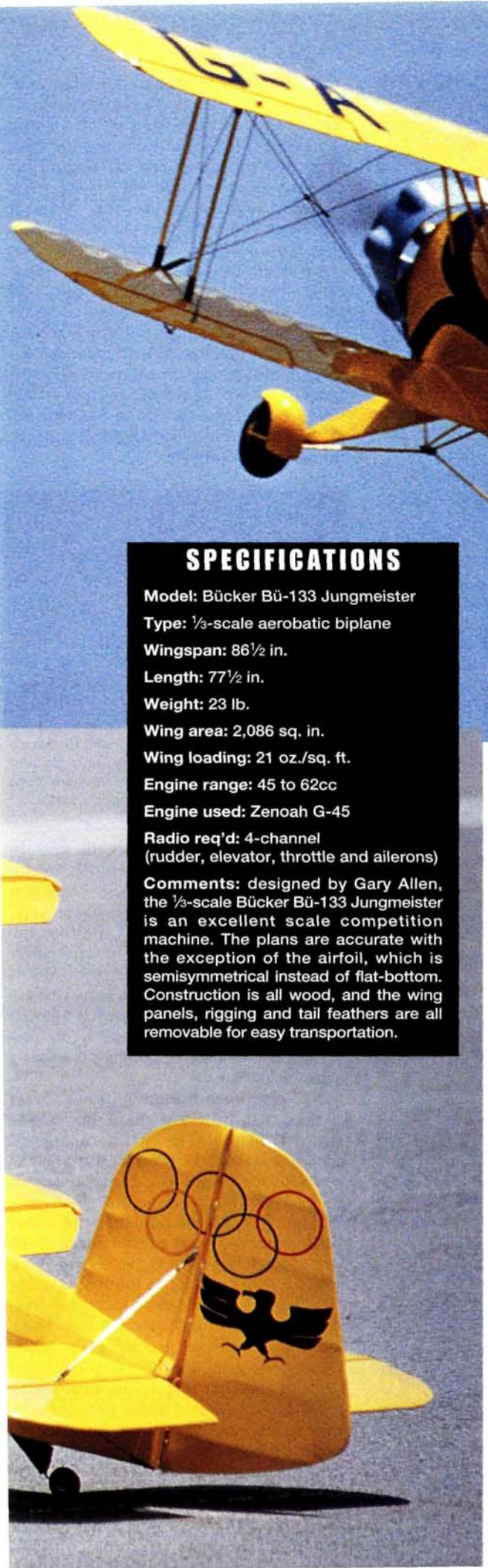
Wing loading: 21 oz./sq. ft.

Engine range: 45 to 62cc

Engine used: Zenoah G-45

Radio req'd: 4-channel (rudder, elevator, throttle and ailerons)

Comments: designed by Gary Allen, the ⅓-scale Bücker Bü-133 Jungmeister is an excellent scale competition machine. The plans are accurate with the exception of the airfoil, which is semisymmetrical instead of flat-bottom. Construction is all wood, and the wing panels, rigging and tail feathers are all removable for easy transportation.



CONSTRUCTION

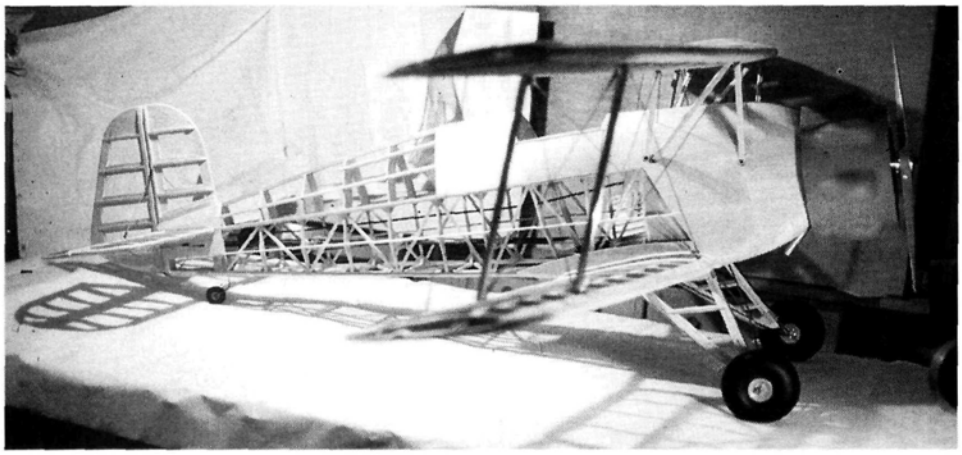
Construction is reasonably straightforward, and the experienced builder shouldn't require detailed, step-by-step instructions. It's important that the steps be performed in sequence, however.

Make two fuselage sides directly over the plans. Note that the longerons are ¼x⅜-inch spruce. Be sure to add the vertical-grain ¼-inch balsa fill, and use epoxy to attach the various ¼-inch ply parts, for example, the nose piece, F-15; the cabane mounts, F-18 and F-19; and the lower wing mount, F-21. Making a right and a left side, add the 1/16-inch ply doublers and gussets, then epoxy F-20 into place to finish the rear cabane strut mount.

Fabricate the landing-gear mounts out of ¼-inch ply as shown. Cut and drill the 1/16-inch brass landing-gear straps, then, using them as guides, drill the landing-gear mounting holes to accommodate 6-32 bolts. Install the blind nuts at this time. Fabricate the F-3 and F-6 former assemblies as shown in the cross-sections.

Using slow-setting epoxy, assemble the two fuselage sides with former assemblies F-3 and F-6 and the front and rear landing-gear assemblies. Check to ensure everything is square and properly aligned. After the epoxy has set, add the ¼-inch-square spruce cross-members between F-3 and F-6. Epoxy the four F-22 formers into place, then epoxy the identical top and bottom nose pieces, F-16, and the two firewall mount pieces, F-17, as well. Use clamps to hold everything in place while the epoxy sets. Again, it is important to ensure that everything is properly aligned. For easy reference, I marked the centerline on all top members. After the epoxy has set, hammer in the small reinforcement nails as shown. Add ¼-inch cross-grain balsa fill from F-15 to F-3, from the fuselage top to the front landing-gear mount on the bottom.

Pull the rear fuselage sides together and glue the tail post into place. Add the ¼-inch-square balsa cross-members and gussets as shown in the plans. Add a 3-inch length of ¼-inch cross-grain balsa fill by the rear landing-gear mount as shown. Add the nose formers, F-4 and F-5, and add the stringers. Then add the rear formers, F-7 to F-14. Note that F-8 and F-9 are glued together. Next, add the stringers, but don't add the ⅛-inch balsa sheeting at this point. Install the tailwheel mount



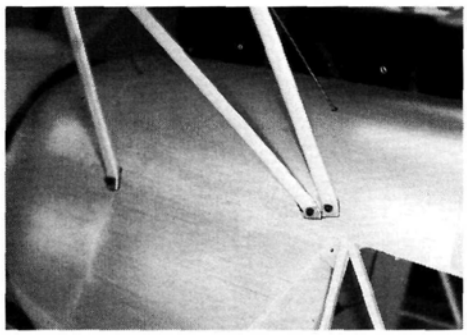
The completed fuselage shows its conventional, all-wood construction.

bracket (a ½A steerable nose-wheel mount) on F-24, then glue the former in the fuselage and add the ¼-inch balsa gussets. Epoxy into place the stabilizer mounts, F-25 and F-26, and add the ¼-inch-square balsa fill as shown in the plan top view. Add the ⅛-inch balsa sheeting, cut out the exits for the elevator and rudder pushrods, then set in place the ½-inch-square, ⅛-inch ply pieces to accept the tail-shroud mounting screws.

Epoxy the ¼-inch ply tail-brace mount to the bottom of the tail post, then fabricate the removable bottom tail hatch from balsa and 1/16-inch ply as shown. Removal of this hatch from the finished model provides access to the steerable tailwheel mechanism, the stabilizer mounting bolts and the pushrod exits.

Now fabricate the bottom wing center section. In preparation, stack pairs of the top and bottom ⅛-inch ply end ribs (two W-5 and W-6 pairs for the top wing and two W-5B and W-6B pairs for the bottom wing). Mark and drill the front and rear holes for the 5/16-inch fiberglass arrow-shaft, wing-mounting studs as shown in the plan. Keep the rib pairs matched for the remainder of the construction.

Carefully draw the mean chord line on the outside of each of these ribs. These lines will ultimately determine the wing incidences, so check them again for accuracy and consistency. Fabricate the front and rear lower wing spars by laminating ⅛-inch ply pieces for maximum strength. Mark and drill holes for the rigging fittings in the front spar. Slide both wing spars through the appropriate slots in F-21, then epoxy them in place. Make sure that both spars are square and are centered to the fuselage and parallel to each other. Install the rigging fittings with 4-40 nuts and bolts. Epoxy the nuts well, as no access is provided in the finished model. Make and install the 1/16-inch brass bottom wing-mount fittings to the front and rear spars as shown. Construct the removable bottom fuselage hatch from 1/16-inch ply as shown. At this point, the basic fuselage framework is complete.



The cabane struts are made from aluminum stock sandwiched between wood strips and sanded to an airfoil shape. They are then screwed into place with cap-head screws.

On a flat workbench, block the fuselage so that its datum line is parallel to the work surface. Glue W-10 and W-11 ribs into place. Epoxy the ⅛-inch ply end rib, W-5B, into position; make sure that the mid-chord line is parallel to the workbench. Add the balsa triangle-stock gussets and the ⅛-inch balsa sheeting and rib capstrips as shown. Drill the 5/16-inch holes in W-5B through W-11 and epoxy the 5/16-inch fiberglass arrow-shaft wing-mounting studs into place.

Now fabricate the upper wing center section, then make the aluminum cabane struts. Drill the holes in the cabanes to accommodate 6-32 bolts and make the bends in their ends as shown. Be sure to make right and left versions of each cabane. To make certain that the upper wing center section is exactly aligned relative to the lower wing center section, construct a temporary jig as follows: working directly over the side view, locate the fuselage bottom wing center section. Next, locate the completed top wing center section on the plan. Tie the two wing center sections together directly by tack gluing three pieces of hard balsa or spruce ¼-inch square stock to the end ribs, W-5 and W-5B, on both sides of the fuselage, in the form of an "N." Next, glue cross-braces between the jig members to restrict side-

FLIGHT PERFORMANCE

• GENERAL FLYING CHARACTERISTICS

Of all the model Jungmeisters I have flown, this ⅓-size version is certainly the easiest. As recommended in Greg Hahn's "Speed, Props and Power" article (*Model Airplane News*, March 1998), I fitted a 22x8 propeller to the engine. When correctly tuned and well broken in, i.e., more than 10 hours running time in my hands, my G-45 turns a very mellow-sounding 6,400rpm. This results in plenty of power for large, scale-like loops, easily sustainable knife-edge flight and other assorted maneuvers such as rolling, pitching and snapping. Vertical performance is definitely not unlimited, but a sufficient vertical line can be achieved to allow nice-looking stall turns and wingovers. Pilots who want performance more akin to a modern aerobatic biplane might prefer a G-62 engine.

• TAKEOFF AND LANDING

Unlike its full-size counterpart, this ⅓-size Jungmeister is fitted with a steerable tailwheel that makes taxiing and taking off a breeze. When full power is gradually applied, the model tracks quite straight; only a little right rudder is required. Off grass, the model is airborne in about 75 feet. When executing a procedure turn to the right, a bit of coordinated rudder and aileron is required to overcome the considerable torque generated by the big gas burner. Once airborne, the big biplane is amazingly stable. Landings are as easy as takeoffs. Like most biplanes, it is important to keep a bit of power on until just before touchdown. On my first flight, I made a perfect 3-point landing! Fortunately, one of my flying buddies captured it on film.

• AEROBATICS

I am not a very accomplished aerobatics pilot, but with this ⅓-size Jungmeister, I can easily execute point rolls, loops, single- and double-avalanches, level and climbing knife-edge flight, flat spins, snap rolls from any attitude, inverted flight, and so on. I tend to fly this model at full throttle most of the time. The large frontal area results in fairly constant speed—slow. This is by far the most fun model that I have ever flown.

to-side motion. The top wing center section should now be rigidly located in exactly the correct position relative to the fuselage.

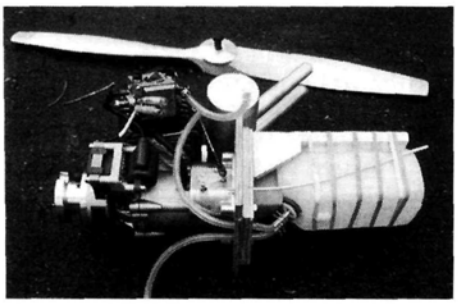
The top center section incidence should be minus 1 degree relative to the bottom wing. An incidence meter can be used, but I measure the difference in distance between the front and rear positions of mean chord lines of the top bottom wing end ribs. Once satisfied with the position of the top wing center section, fit and adjust each cabane strut to get the bend angles exactly right, then bolt them to the fuselage. Next drill directly through the top cabane strut holes into the top wing center section ribs to accept 6-32 bolts, add the blind nuts and tighten them. Remove the jig.

Remove the top center section and the cabane struts from the fuselage. Add the side formers F-1S through F-4S, plus the 1/8x1/2-inch balsa strip. Add the 1/8-inch balsa sheeting to the nose of the fuselage and to the rear of the cockpit. Shape and glue into place the top and bottom balsa nose blocks. Locate the fuselage cabane-strut mounting positions, and carefully cut away the sheeting for a good fit. Add the 3/8-inch balsa wing-saddle piece, F-23. Add the 1/8-inch sheet-balsa fuselage side stringer and braces. Carve and sand the finished fuselage to shape.

Fabricate the servo mounts from 1/8-inch ply and 1/4x1/2-inch spruce rails. I used one standard servo for each elevator and a single 1/4-scale servo for the rudder. Support the outer pushrod tubes in at least four places. Fabricate the throttle servo mount and install it in the fuselage.

ENGINE MODULE

I designed the engine module to provide easy access to the engine-mount bolts and the fuel tank. It consists of the 3/8-inch firewall and an 1/8-inch, lite-ply fuel-tank platform. Remember to drill the holes for the six, 6-32 firewall mount bolts with the firewall in place and be sure to drill through the F-17 firewall-mount piece. Install and epoxy the blind nuts in F-17, then epoxy the hard-balsa triangle stock into place as shown. The tank is mounted



The engine and firewall are removable. The module setup includes the fuel tank but not the throttle servo, which is mounted within the fuselage. The throttle linkage must be undone for the module to be removed.

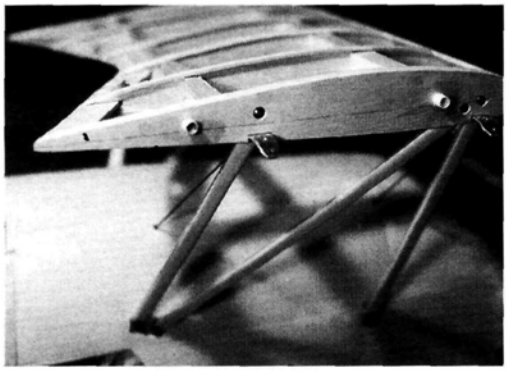
TO ORDER THE FULL-SIZE PLAN, FSP0300A, SEE PAGE 146.

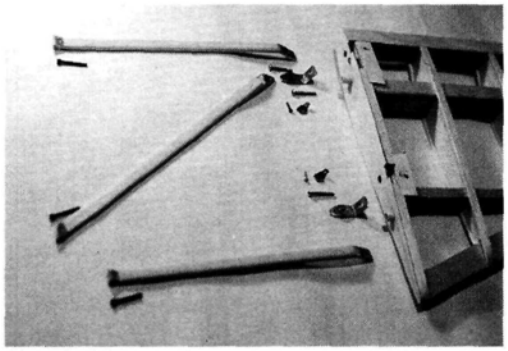
Editor's note: the author's notes and photos pertaining to rigging the wing's flying and landing wires are included with the plan.

over ½-inch foam and held in place with five no. 64 rubber bands. The throttle servo is mounted in the fuselage, so to remove the engine module, you must first loosen the pushrod connector to release the throttle pushrod from the carb.

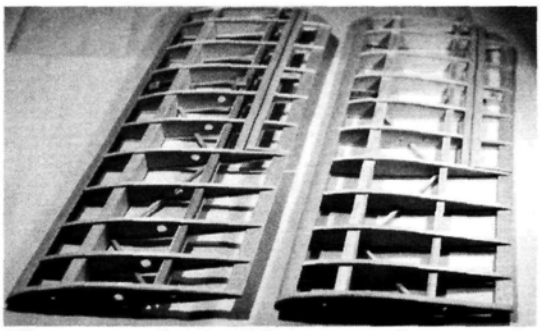
TOP WING CENTER SECTION

Lay out the bottom spars over the plans. Block up the rear spar with a ¼-inch balsa stick. Locate, square and glue in the W-1 and W-2 ribs. Assemble the ¼-inch balsa, W-4, and ⅛ ply rib, W-3, and glue them in. Add the top spars. Note: the top rear spar is made by laminating 1/16-inch-thick spruce into place. Add false leading- and trailing-edge (LE and TE) pieces. After you've beveled the top of the false LE, add the top LE sheeting and the top rib capstrips. Remove the assembly from the plan, then add the bottom LE sheeting and capstrips. Sand the LE sheeting flush with the false LE, then add the ¼-inch balsa LE. Add the ⅛-inch ply cabane mount reinforcement pieces to W-3. Working on a flat surface, carefully epoxy and clamp the two W-5 end ribs into place, and make certain there are no warps in the structure and that the mid-chord lines are parallel to each other. When everything is set, sand the wing to shape using the end cap ribs as a guide. Drill the 5/16-inch holes in W-5 through W-4 and W-3, and epoxy into place the 5/16 fiberglass arrow-shaft wing-mounting studs.





Top: the upper wing center section in place atop the cabane struts. Note the chord line drawn on the rib; it is used to make sure that the wing is rigged properly. Above: here are the cabane struts, mounting brackets and hardware and the upper wing center section.



Wing construction is fairly easy, as all four panels have a constant chord width.

WING PANELS

In preparation, fabricate the ply, interplane-strut mounting assemblies. Note that the top wing-panel assembly is one piece, and the bottom wing-panel mounts are comprised of front and rear assemblies. Don't forget to install the small reinforcement nails. Place the bottom spars over the plans while you block up the rear spar with a ¼-inch balsa stick. Glue into place the W-7, W-8 and W-9 ribs and epoxy the ⅛x½-inch ply strip to the bottom spars and against the first W-7 rib, as shown. Epoxy into place the interplane strut-mount assemblies, and note whether you are making a top or bottom wing panel. Use the root rib templates to get the correct dihedral angle for the first W-7. Remember, this is different for the top and bottom wing panels. Do not glue W-6 or W-6B into place at this time. Add the top spars. Add the false LE, the ¼-inch balsa aileron-mount piece, the TE and the gussets. Add the 1/16-inch balsa shear webbing then install the ¼-inch cross-bracing flush with the bottom spars. After you've beveled the top of the false LE, add the top LE sheeting, the top aileron-mount sheeting and the top rib capstrips.

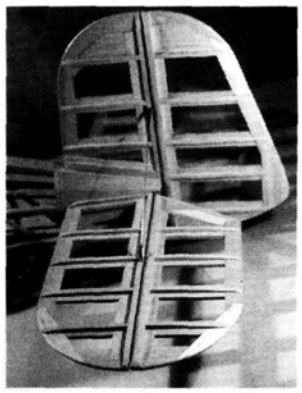
Remove the wing assembly from the plan and add the bottom LE sheeting, the bottom aileron-mount sheeting and the capstrips. Sand the LE sheeting flush with the false leading edge, then add the ¼-inch balsa LE. Glue the wingtip into place and add the balsa braces. Apply 1/32-inch ply lamination strips to the wingtip edge then add and shape the small LE wingtip blocks.

Aileron servo installation is shown on the plan. Carefully study the arrangement of the bottom aileron servo control horn and the aileron linkages. It is important that the geometry of the top and bottom aileron linkage horns be identical. Note that the aileron linkage horns are made from modified, standard, large control horns.

TAIL PARTS

By design, the entire tail may be removed from the model. First, glue together the ¼-inch balsa tail frameworks over the plan, then add the ⅛-inch ply control-horn mounts to both sides of the elevator halves and the rudder. Next, add the ¼-inch-square balsa ribs, TEs and LEs. Set in the 1/16-inch ply tail-brace mounts and the fin-to-tail shroud mount. Mark and cut the hinge slots in the tail parts and the tail post for the rudder. Sand everything to shape.

Epoxy the ¼-inch ply stabilizer mounts into place on the stabilizer top center section; make certain that these are exactly aligned with the fuselage stabilizer mounts. Add the ¼-inch balsa filler on the top and bottom of the stab, then position it on the fuselage and clamp it into place. Carefully mark and drill the four, ⅛-inch holes for the 4-40 stabilizer-mount bolts, then install the blind nuts. Next, fabricate and epoxy into place the front and rear fin mounts and install the 4-40 blind nuts. Temporarily assemble the control surfaces, then attach the horizontal stabilizer and fin to the fuselage with 4-40 bolts. Drill pilot holes in the tail post to pin the rudder hinges into place with two, no. 4 wood screws. Remember not to glue these two rudder hinges into the fuselage.

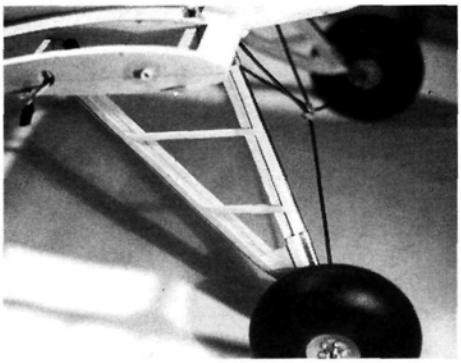


The tail feathers are of traditional wood construction, and the entire unit is removable.

The tail shroud should be flush with the fuselage rear deck stringers and should be made from ⅛-inch balsa. Remove the shroud and cover it with 1/32-inch ply to simulate the metal panel. Note that the 1/32-inch ply should overlap the rear deck stringers and that a tab should extend below the front of the stabilizer. The shroud is held in place with four, no. 2 wood screws screwed into the fin shroud mount.

LANDING GEAR

Cut the front and rear struts to length from ¼-inch music wire, and bend them to shape. Note that the rear struts are made in two sections and joined by a short length of brass tube. To ensure the proper shape and position, assemble and solder the landing-gear struts while they are mounted on the fuselage. Wrap all the joints tightly with thin copper wire and solder them well. From 5/32-inch music wire, cut to length and bend to shape the rest of the landing-gear structure. Note that the pyramid structure has only one



The landing gear is made by soldering music wire together and then adding wooden fairing strips. The entire assembly is then cloth covered.

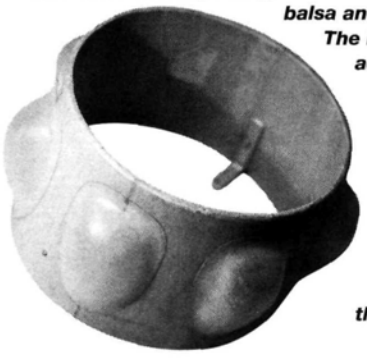
leg connected to the left rear strut, and to provide shock absorption, the lower crossmember (the axles in the full-size aircraft) is attached to the pyramid with a no. 64 rubber band. After the gear has been completed, add the balsa structure and sand to shape.

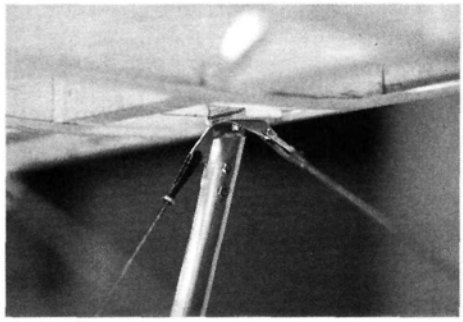
The fenders are very much a part of the Jungmeister's character and should be included on even a fun scale model. Fenders are available from several vendors, but I cannot attest to their scale accuracy. I fabricated mine from several layers of 6-ounce fiberglass cloth and epoxy formed over a carved mold. The brackets and hubs are constructed from wheel collars and brass sheet material.

COWL

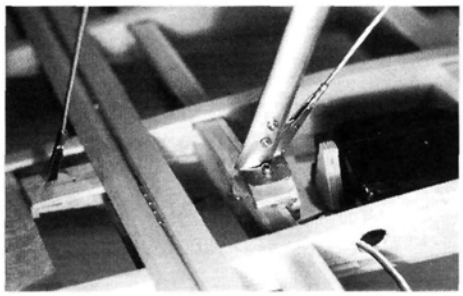
Several older ⅓-scale Jungmeister fiberglass cowls are available, but I chose to fabricate mine from scratch to ensure scale accuracy. The first step is to construct a form with two ⅛-inch lite-ply circles cut to the inner diameter of the front and rear of the cowl. The two circles are centered over each other and separated by lite-ply formers. Next, 3- or 4-inch sections of ⅛-inch sheet balsa are glued to each other then tack-glued to the form. Wet the balsa so it forms easily. After the first layer is complete, apply a second. After it has dried, sand the outer surface to the cross-section shown. While it is still attached to the form, apply 6-ounce glass cloth with epoxy to the cowl. After curing, the cowl is removed from the form, and the inner surface is also glassed. Add a second coat of epoxy both inside and out, then sand smooth.

The cowl on the prototype was made from balsa and plywood. The bumps are added after the cowl has been shaped over a wooden form. Details are shown on the plan.





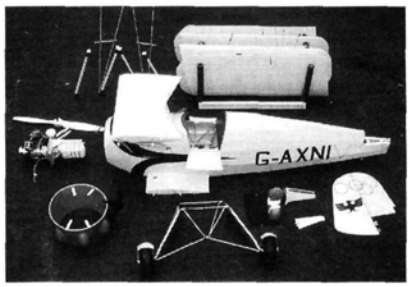
This shows the top wing attachment point for the wing rigging wires. The brass brackets are fairly easy to make.



This close-up shows the right interplane-strut and aileron-linkage attachment setup.

To make the cowl bumps, carve one out of balsa and attach it to the cowl in an appropriate position. Create a fillet around it with epoxy and microballoons, then sand smooth. Fill the imperfections and finish-sand it. Either repeat this six times or use the first bump to make a female mold using Bondo auto-body filler. The rest of the bumps can then be molded from glass cloth, trimmed to shape and epoxied into place.

Make the mounting brackets from ⅛x½-inch aluminum stock and attach them to the cowl with PFM* adhesive. With the engine in place, center the cowl in position and use the holes in the mounting brackets to mark the locations of the cowl-mounting screws in the firewall.



The entire model is designed to come apart for easy transportation. Note that the wing rigging (upper left) is removable and remains fairly intact.

INTERPLANE STRUTS

Fabricate and bend the strut end fittings from 1/16-inch brass, then drill the 7/64-inch holes for the 4-40 wing and rigging mounting bolts. Be sure to make right- and left-hand versions. Cut the interplane struts to length from ⅝-inch streamlined aluminum tubes. Cut them to length and insert the ¼-inch dowel stiffeners, leaving enough space at each end of the strut for the fittings. Insert the fittings into the top and bottom strut ends, and fill the space between the fitting and the strut with scrap basswood. Glue the bottom strut fittings into place with a little CA, then mark, drill and add the two 2-56 bolts and nuts. The top strut fittings will be glued and bolted into place during the rigging procedure.

FINISHING

I covered the fun fly version of the two models with Oracover*. It is quick, durable and looks great. It is, however, not really scale. I covered the scale competition model with Solartex*. For this version, I also constructed the wing fairings and the ply wing walk. The major parts for the wing fairings are shown in the plans. I added rib stitching (white glue) and rib reinforcement tape (3M hair-setting tape), and I simulated the top and bottom nose metal panels with primer. I made the nose metal side panels and the luggage compartment cover from polystyrene plastic. For either version, construct the windscreen and the cockpit crash pad as shown and glue them into place with J&Z Products* RC-56 glue. Other details include the Pitot tube, the wing walk, the zippered fuselage access panel on the left side, the external fuel gauge, the interplane strut and rigging wire leather boots, and the aileron and elevator trim tabs. None of these details is very difficult to make. Dozens of well-documented color schemes are available for the Jungmeister.

ENGINE AND PROPELLER

The power choice for the ⅓-size Jungmeister was based on the considerations detailed by Greg Hahn in his excellent article, "Speed, Props and Power" in the March 1998 edition of *Model Airplane News*. The full-scale Jungmeister weighed 1,290 pounds fully loaded and was typically powered by a Siemans Sh. 14, 7-cylinder radial engine rated at 160hp, giving a power-to-weight ratio of around 1:8. Assuming that a normally aspirated 2-cycle gas engine yields about 1hp per cubic inch, and applying the full-size power-to-weight ratio to the 21-pound model, an engine displacement of about 2.7ci would be required for scale-like flight. Accordingly, I selected a Zenoah* G-45 (2.75ci) as a perfect match. With the G-45 fitted with a Bisson* muffler and a spring starter up front, the finished models balanced perfectly without the addition of ballast fore or aft.

I hope you enjoy building and flying your Bücker Jungmeister as much as I did.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

Astro Flight News

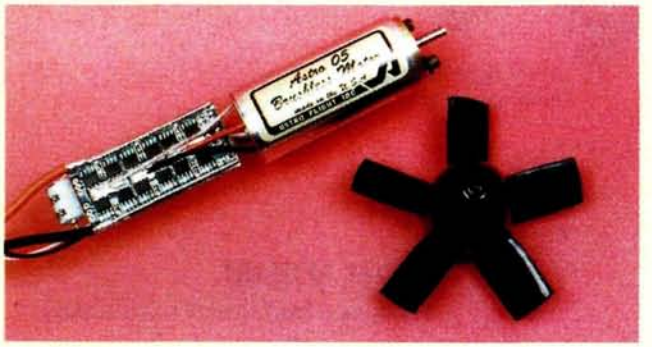
Astro Flight Inc. Introduces five new and exciting products for the electric flyer: The new Mighty Micro 010 Brushless Motor for park flyers, a new Ducted Fan Brushless 05 Motor for the Kyosho T-33, FAI-035 and FAI-05 Planetary Motors for Sailplanes and two new surface mount digital speed controls.

The Mighty Micro is here!

Our new Mighty Micro Brushless 010 Motor #801 has arrived. The motor is one inch in diameter and one inch long and weighs only 35 grams with sensorless control. It spins an APC 6x2.8 prop at 9800 RPM while drawing only 2.5 amps from a six cell 350 mahr Nicad pack. Now you can fly for 5 minutes on Nicads, 10 minutes on Hydrides and one hour on lithium cells. The tiny On-Off Brushless control has Brakes and BEC. This system will work with 5 to 8 cell batteries. Perfect for models up to 10 oz.

New Ducted Fan 05 Motor!

Our new 4 turn Brushless 05 Ducted Fan Motor #805F with 12 FET controller is specially designed to add Afterburner performance to the Kyosho T-33 and WE-Mo-Tek 480 ducted fan units. Run the T-33 fan on 8 or 9 Nicads or 10 Sanyo 3000 mahr Hydrides. The motor draws only 19 amps for 10 minute flights on Hydrides.

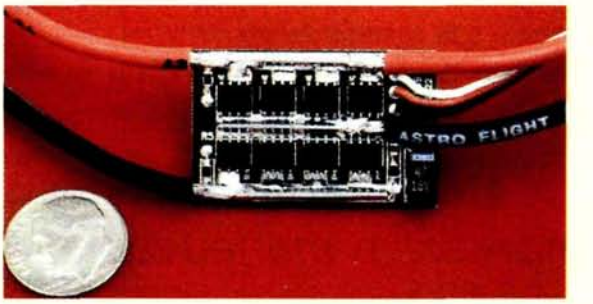


FAI-035 with Planetary Gearbox

Our new 4.4:1 planetary gear box is now available for all Astro Cobalt 035, 05 and 15 motors. The FAI-035 with planetary gear box is perfect for 7 cell competition sailplanes. The FAI-05 with planetary gear box, shown here, is perfect for 10 cell sailplanes.

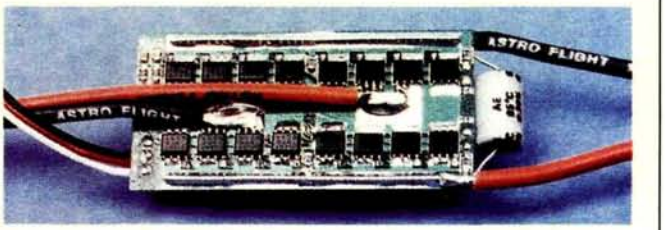
New Astro 215D Airplane Control

The new Astro 215D Speed control uses new surface mount technology for minimum size and maximum performance. The tiny 215D weighs only 8 grams and has Brakes and BEC. It handles up to 30 amps and 10 cells. Perfect for Astro Cobalt 035, 05 and 15 motors.



New 208D Reversing Control

The new 208D Reversing Control is designed for scale boats. It's 16 FET H-Bridge circuit gives you full power forward and reverse. The 208D weighs 1 oz and can handle 25 amps at 6 to 12 volts. It has a 2 amp BEC and a electronic current limit of 28 amps, so no fuses are needed. It was designed for tug boats and works great with 150 pound robots and electric powered blimps.



Astro Flight Inc. 13311 Beach Ave. Marina Del Rey, CA 90292
Phone (310) 821-6242 Fax (310) 822-6637 Web Site http://www.astroflight.com

IMAC Aerobatics: The Rolling Circle

by Dan Wolanski

Nothing is more showy than a rolling circle performed by a scale aerobatic model, such as this Lanier* RC Extra 300S.

In the 1930s, Gerhard Fieseler, a German aerobatics pilot in search of a new maneuver, invented what is now known as the rolling circle. To this day, the rolling circle—or "roller"—is the single most difficult aerobatic maneuver to perform. In its most basic form, a roller is a turn of an aircraft 90 degrees or more while the plane is rolling. It sounds simple, but a proper rolling circle requires intense concentration to complete, using all of a pilot's transmitter inputs at precise intervals. A rolling circle requires the use of elevator, aileron, throttle and especially rudder; in fact, the rudder is key to the maneuver, but many beginners disregard this because of the difficulty in coordinating rudder inputs with the plane's attitude. If you try to perform a roller using only ailerons and elevator, you'll have no control over the number of revolutions needed to get the plane to complete a circle. Your headings for each quadrant must be planned.

Conquer this impressive maneuver

Figure 1. The first quadrant of a rolling circle from upright to the inside.

HOW TO BEGIN

To start, you need to decide which variation of the roller you want to learn. These factors should be considered:

- The more revolutions you make, the easier it is to get the plane to complete a circle.
- Pulling into a maneuver feels much "safer" than pushing, so an inside rolling circle (in which the plane rolls to the inside of the circle instead of to the outside) is easier to learn.

At first, favor your "strong" roll direction (clockwise or counterclockwise)—the direction in which you can hold a very precise, slow roll rate while giving other inputs.

Bearing in mind that pilot skills vary, I will explain a very simple four-roll circle, flying from left to right.

TRYING A ROLLER FOR THE FIRST TIME

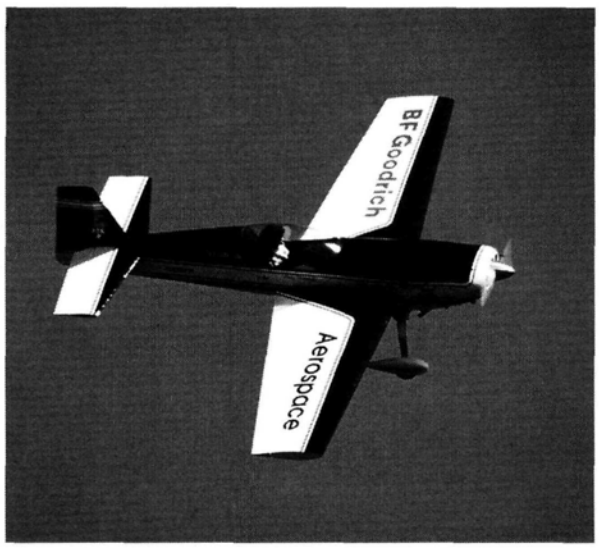
Since the roller requires a considerable amount of timing and concentration, it's best to practice it one quadrant (¼ circle) at a time initially. As you become more proficient, you can string the quadrants together. Practicing in quadrants will help you to identify what the plane should look like at each step and will also require much less concentration. Take your plane up at least one mistake high. Enter the aerobatic box, flying from left to right at ½ to ¾ throttle, and proceed to the center of the box. As you pass the center, slowly feed in left aileron and a touch of left rudder. You will hold this aileron setting throughout the maneuver.

As the plane approaches 15 to 20 degrees of rotation, slowly feed in up-elevator and a little left rudder. Both the up-elevator and left rudder turn the plane toward the center of the circle. Keep in mind that too much elevator will cause the plane to rise. Transition to right rudder, then continue to feed in slightly more elevator and rudder as you slowly roll to knife-edge flight. Keep the plane rolling at a very slow, constant rate; then, as you pass knife-edge, slowly reduce up-elevator while holding right rudder steady. The rudder will help you to continue "sliding" your plane in a circular fashion. Bear in mind that if you do not release up-elevator soon enough, you will start to pull the plane toward the ground, and all the rudder in the world won't help you keep its nose up.

During the 90 degrees of rotation between knife-edge and inverted flight, keep right rudder constant, but transition from up-elevator to very slight down-elevator. Now you are halfway through the *first* quadrant of the circle! At this point, you're 45 degrees into a complete rolling circle and are about to encounter the more difficult half of the rotation.

As the plane begins to roll past being inverted, slowly decrease right rudder and begin to input slightly more down-elevator. This will cause the plane to continue on its circular course. Now you must transition from right rudder to left. If you hold right rudder too long, the plane's nose will tip toward the ground. Transition your plane as it passes the 270-degree rotation point (opposite knife-edge) by inputting down-elevator and left rudder. At this time, hold only enough rudder to prevent the plane from falling, and adjust down-elevator to bring the plane perpendicular to the flightline (it will be heading straight away from you).

You must release all down-elevator by the time you're about 20 degrees of rotation shy of rolling upright or you will once again push the plane downward. If you come up short, input more left rudder to slide the plane around. During the last 20 degrees of rotation to upright, it helps to input a little up-elevator as you roll. This will help to keep the nose up.



Now you have just completed ¼ of a rolling circle! Continue to practice this quadrant, then move on by flying your plane straight away from you and starting the next quadrant from wings level. Don't try to tack the second quadrant onto the first yet; the plane will look very different to you on the back side of the circle. When learning a roller, it's best to enter each quadrant from straight and level flight until you feel comfortable with each section; after that, you can string the quadrants together as your confidence grows.

VARIATIONS

The most common rolling circle variations are a change in the direction of the roll—from inside to outside—and a differing number of rotations—between one and four. An outside roller is more difficult to learn than an inside roller; once again, the key to this variation is the rudder. With an outside roller, you lead with a lot more rudder to get the plane to turn toward the center of the circle. Also, reducing the number of rotations makes the maneuver considerably more difficult, since you have to slow your roll rate and increase the other inputs to end up at the correct reference points.

HINTS AND TIPS

You may want to set up a low-rate aileron or increase your differential to make your ailerons less sensitive around neutral. This can be accomplished easily with a programmable radio. Resist the temptation to limit your aileron throw so you can bury the sticks and achieve a slow roll rate. Doing this is like asking for disaster; if you need to bail out of the maneuver, you have only 10 percent of your normal aileron throw. You may also consider going to a higher-rate rudder as you will need this input the most during the maneuver.

One other bit of advice: you can get away with inputting a lot of rudder during the upright and inverted portions of a roller without its looking too jerky. All of the other inputs, however, require a tremendous amount of finesse, and adverse input will blow the maneuver. Keep in mind that if you do use a lot of rudder, you will need to add throttle because of the drag produced by control-surface deflection.

I hope this has inspired you to attempt a roller. If you would like more information on how to perform aerobatic maneuvers or sequences, visit the International Miniature Aerobatic Club website at www.mini-iac.com. Have fun with the roller and don't get discouraged if it takes you a few months to learn this maneuver. Nothing is more impressive to your fellow club members than a properly done rolling circle. Heck, when I hit a good one, it impresses me, too!

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✚

Easy-to-fly, sport-scale ARF

KYOSHO 182 Skylane 40

by Jim Onorato

Cessna airplanes are certainly some of the more popular light aircraft on the market today. Among the various Cessnas available, the 182 Skylane ranks high on the list because of its powerful engine and luxurious furnishings. Several companies manufacture RC models of this airplane, and the one that caught my eye was the new Kyosho* ARF; I was really impressed with its scale appearance. My affinity for Cessnas goes way back; my first .40-size RC airplane was a now-discontinued kit of the Skylane 62, which I still fly from time to time.

THE KIT

The word "kit" doesn't generally apply to ARFs, and it certainly doesn't to Kyosho's Cessna. This plane is 80 percent complete and includes everything you'll need to get flying except for the radio, engine, propeller, spinner and fuel tubing. I was amazed at how light the box was, and I was pleasantly surprised when I opened it and saw the excellent quality of this model. The three wing panels are constructed of balsa sheeting over foam cores and are covered with white film. The uniquely shaped wingtips are molded fiberglass, and the tail feathers are pre-assembled balsa frames that are also covered with white film. The fuselage, cowl and wheel pants are made of molded fiberglass and are covered with white gelcoat. The plane does not require any painting; just use the supplied decals, and you've finished detailing it. A fuel tank, landing gear, sponge tires, engine mount, molded windows and a very complete hardware package (with metric nuts and bolts) are also included.

SPECIFICATIONS

Model: Cessna 182 Skylane 40 ARF

Manufacturer: Kyosho

Type: sport-scale ARF

Wingspan: 62.2 in.

Wing area: 507 sq. in.

Airfoil: semisymmetrical

Weight: 5 lb., 11 oz.

Wing loading: 25.8 oz./sq. ft.

Length: 44 in.

Radio: 4-channel with 5 servos

Engine req'd: .32 to .46 2-stroke, or .48 to .52 4-stroke

Engine used: O.S. FS 52S 4-stroke

Street price: $240

Features: 80 percent complete ARF. White, gelcoated, molded-fiberglass fuselage, cowl and wheel pants. Balsa-sheeted, foam-core wings and built-up tail feathers precovered with white film. Complete hardware package.

Comments: as a Cessna lover, I may be biased, but this is a nice-looking, nice flying model. It goes together quickly and easily, so you can be in the air in no time.

Hits

- Realistic, scale-like flight performance.
- Excellent scale appearance.
- High-quality, white-gelcoated, molded fiberglass parts.
- Easy to assemble.
- All hardware included.

Misses

- Clear plastic parts were stained and cloudy (subsequently corrected).

PHOTOS BY JIM ONORATO

FLIGHT PERFORMANCE

Before the first test flight, a friend of mine told me that he found the Cessna to be quite sensitive at the recommended control throws. Never one to take unnecessary chances with a new airplane, I used the recommended throws for the high rate but set the low rate at 60 percent. My initial flight was at low rate.

• TAKEOFF AND LANDING

I pointed the Cessna into the wind and slowly advanced the throttle. The plane tracked beautifully without any need for right rudder. When my model attained flying speed, I applied just a touch of up-elevator, and the Cessna rotated slightly while lifting smoothly into the air. Very realistic!

The Cessna has a shallow glide slope, which makes landings a real pleasure. I set up a long approach and throttled down to establish the rate of descent while using a slight amount of up-elevator to reduce the flying speed. I didn't flare quite enough on the first landing, and the nose wheel dug in, causing the plane to flip. Pilot error! On subsequent landings, I let the main wheels touch first, and the rollout was smooth.

• LOW-SPEED PERFORMANCE

The Cessna flies smoothly at low throttle, but you have to be careful not to let it get too slow or apply too much up-elevator. This plane does not stall straight ahead. In most cases, when I intentionally put it into a stall, the right wing dropped sharply. The best thing to do is test the stall speed at a safe altitude and adjust your flying accordingly.

• HIGH-SPEED PERFORMANCE

Powered by the O.S. FS 52S engine, the Cessna flies much faster than scale speed. I did most of my flying at ½ throttle and only used full throttle when I wanted to gain altitude quickly or when I initiated maneuvers. The model flies very smoothly at high speeds but does look a little out of character.

• AEROBATICS

The Cessna is not designed for aerobatics, but it is capable of performing enough maneuvers to keep most Sunday fliers happy. Its rolls can be slow and realistic at a low rate or reasonably fast at a high one. The Cessna does large loops without losing heading and flies inverted with application of some down-elevator. I did encounter rollout at the top of a full-elevator deflection loop done at high rate, but I eliminated the problem by simply reducing elevator throw. The Cessna spins nicely and recovers immediately when the controls are released.

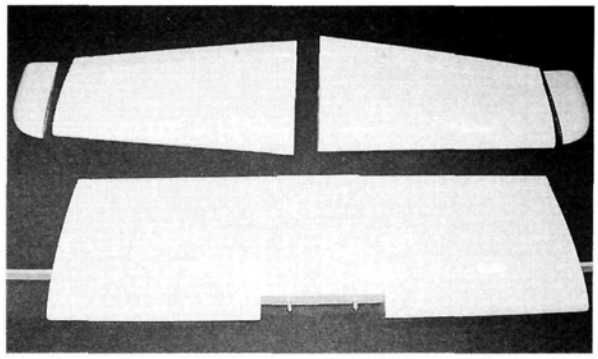
Overall, the Kyosho Cessna 182 Skylane 40 ARF flies very realistically.

The 20-page instruction manual will guide you through assembly without the need for full-size plans. Much like the manuals Kyosho uses for its RC cars, it includes a lot of symbols, photos and drawings but very few words. It is written in both Japanese and English, and all of the dimensions are in millimeters.

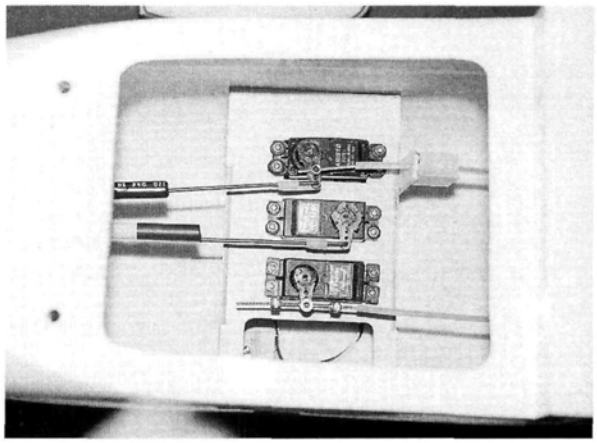
ASSEMBLY

As the first step, the instructions recommend that you apply the decals to both sides of the fuselage and open the slots for the rudder and elevator pushrods. This actually can be done later, as long as it is done before the stab is glued into place.

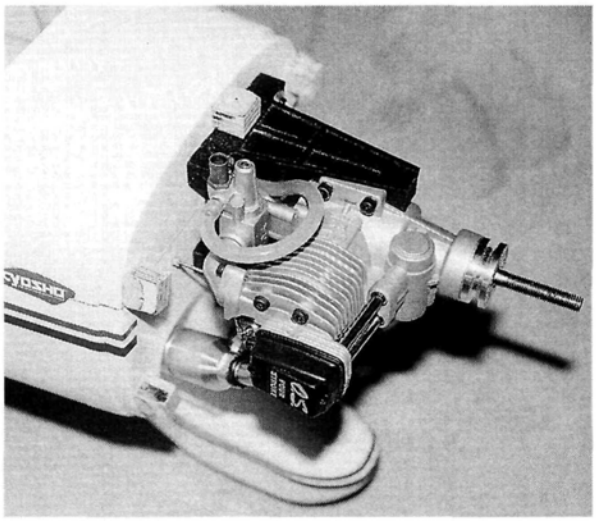
The next few steps cover assembly of the wing, which comes in five pieces: the center section, two outer panels and two tips. The ailerons have already been installed on the outer panels, but you'll have to secure the hinges with a few drops of glue. The hinges are circles, which makes them very easy to install in the slots—quite a neat and unique way to do it! Next, cut the covering away in the outer wing panels for the aileron servos, and epoxy the hardwood servo-mounting blocks into place. Full-size servos stick out of the underside of the wing and can be covered with oval-shaped, white plastic "bubbles," but I used miniservos so they wouldn't protrude much; this eliminated the need for the bulky plastic covers. This kit also included predrilled holes in the wing for the aileron servo extensions, which exit the underside of the center section of the wing, just above the cabin. Die-cut plywood wing joiners that slide into pockets in the wing panels join the outer panels to the center section. I aligned the panels and glued them together with 30-minute epoxy. Last, I epoxied the tips into place, and the wing was essentially complete.



The wing comes in five pieces that must be assembled. The main wing pieces are balsa wood over foam and have been covered with white film; the wingtips are molded fiberglass.

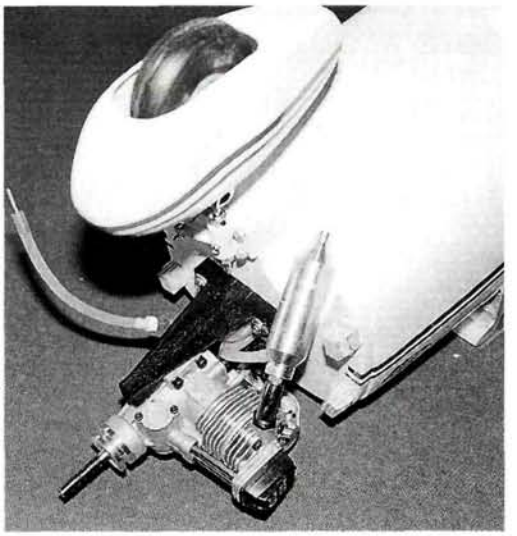


The factory-installed servo tray houses the rudder, elevator and throttle servos.



This side-mounted O.S. 4-stroke fits well inside the cowl and provides more than enough power.

Next, you temporarily attach the wing to the fuselage. The forward hold-down dowels, which are aluminum instead of wood, are attached to the wing at the leading edge (LE). The instructions recommend that you use two, 4mm, metal bolts with blind nuts to attach the wing to the fuselage, but I added a piece of ¼-inch ply-



The firewall has a tunnel-like cutout for the muffler, but if you use a 4-stroke, you will have to find a 2-stroke header to make your engine fit nicely.

wood in the fuselage and used two, ¼-20 nylon bolts instead. After making sure the wing was aligned properly, I drilled and tapped the plywood for the nylon bolts. The preshaped wing struts attach using the special hardware that is provided in the kit. While the wing was still attached, I epoxied the stab and fin to the fuselage, then added the elevators and rudder.

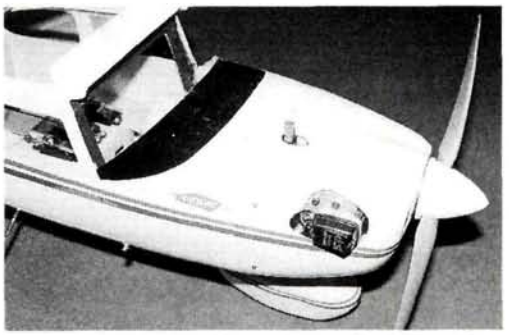
The main landing gear, wheels and wheel pants went together with no problems. However, the wheel pants sit quite low on the axles and leave very little of the wheels exposed if you use the original holes. This turned out to be a bit of a problem on our grass field, so I later drilled and repositioned them so more of the wheel showed. Next came the engine. I used an O.S.* FS 52S 4-stroke, which I installed sideways on the mount provided with the kit. The firewall has a tunnel-like cutout in the lower right corner into which the muffler is supposed to fit so the exhaust can exit from the underside of the fuselage. This probably works just fine for 2-stroke engines, but the exhaust header that came with the FS 52S caused the muffler to hit the firewall. Fortunately, I had a header from an O.S. 48 Surpass, and that fit just right.

When it came to attaching the nose-gear bracket to the firewall, I found it almost impossible to get the four nuts and washers onto the bolts from the inside of the fuselage. It was much easier to insert the bolts from the inside while placing the nuts and washers on the outside. At this time, I also installed the nose gear, wheel, wheel pant and steering pushrod as well as the throttle pushrod.

Assemble and install the fuel tank and fittings next. The tank has a third tube that should be used for filling. I installed a check valve in this line and passed it out through the bottom of the fuselage. Then, I made the engine cutouts in the cowl and attached the cowl to the fuselage with five sheet-metal screws.

I mounted three standard servos in the factory-installed servo tray and made the rudder and elevator linkage rods as per the instructions. All of the necessary hardware was included in the kit. I never use EZ connectors on primary controls, so I did not use the ones that were provided to attach the rudder and elevator rods to the servo arms; instead, I used L-bends with snapper keepers. I placed the receiver in the servo tray and used hook and loop fastener to attach the receiver battery to the former just behind the tray. The CG came out 3 inches behind the LE of the wing—where the instructions recommend.

I encountered the kit's only "miss" when I installed the clear, formed windows and windshield. All of the pieces were stained and cloudy. Kyosho has since corrected this problem, but I decided to spray paint the inside of the clear plastic parts with Testor's* transparent blue paint, which not only concealed the flaws but also gave the Cessna a bit more color. The fuselage former located at the LE of the wing is rather large and unsightly, making the addition of a pilot figure somewhat difficult as well. With the tinted windows, this was no longer a problem.



Covered in white gelcoat, the molded-fiberglass cowl and wheel pants give Kyosho's Cessna a nice, finished look.

The final construction step is to apply the rest of the decals. Their placement is not shown in the instructions, so use the photo on the box as a guide.

CONCLUSION

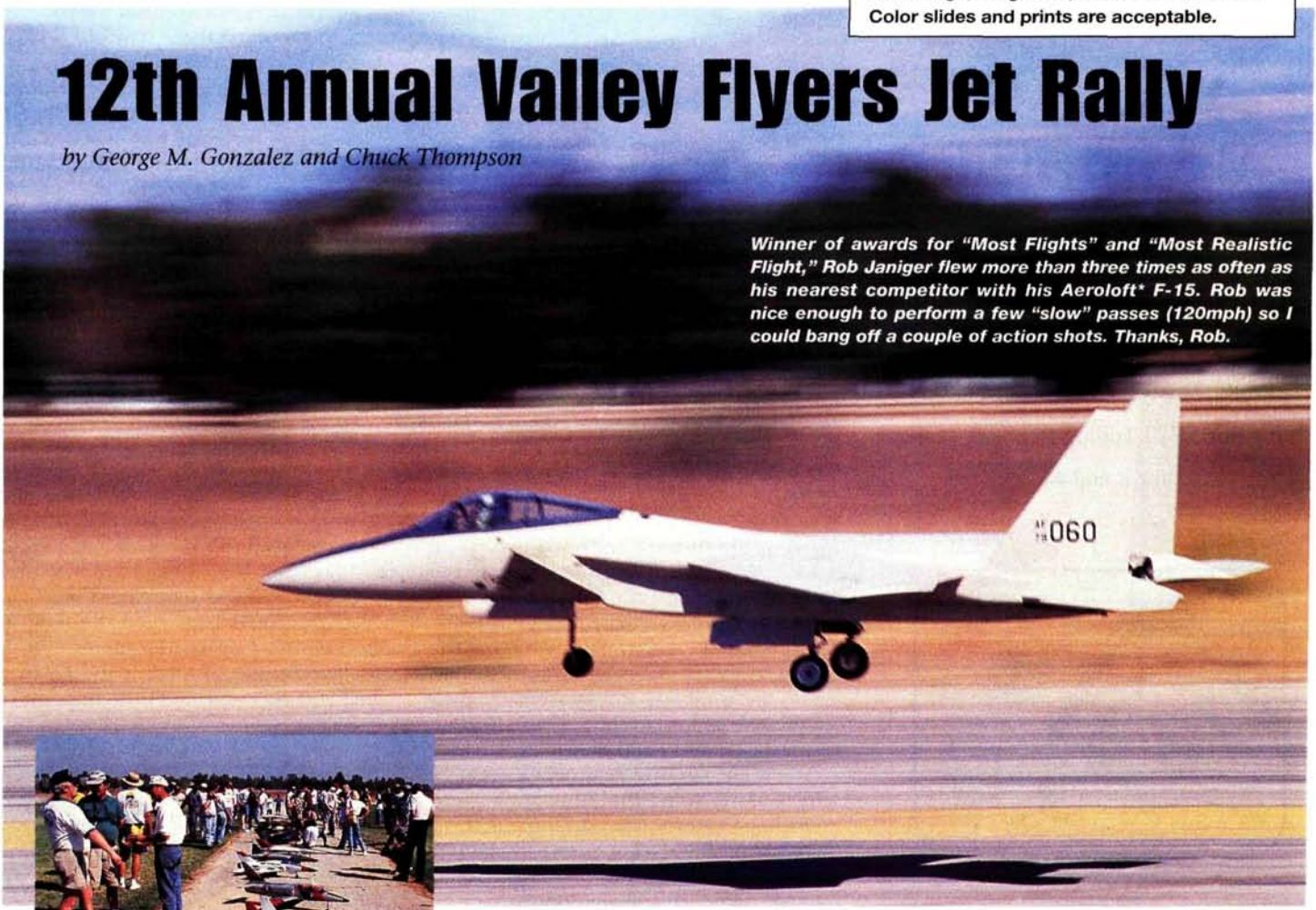
I found the Cessna to be a well-made ARF that went together easily and had a very realistic scale appearance when completed. If you want to get into the air quickly with something that looks like a real airplane and flies great, then Kyosho's Cessna 182 Skylane 40 ARF may be the thing for you. I really like this one!

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✦

Send in your event coverage. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.

12th Annual Valley Flyers Jet Rally

by George M. Gonzalez and Chuck Thompson



Winner of awards for "Most Flights" and "Most Realistic Flight," Rob Janiger flew more than three times as often as his nearest competitor with his Aeroloft* F-15. Rob was nice enough to perform a few "slow" passes (120mph) so I could bang off a couple of action shots. Thanks, Rob.

Left: the "Parade of Jets" was one of the few chances for spectators to get "up close and personal" with the models and pilots.

This is one of the many F-15s at the Rally. The F-15 was the most popular jet by far.

For the past 12 years, the San Fernando Valley RC Flyers—who fly at the famous Apollo 11 field in Van Nuys, CA—have hosted an annual Jet Rally and Fun Fly. The event has become one of the club's most successful ventures. At their most recent event, skies filled with warbirds from every branch of the Armed Forces enticed thousands of spectators away from a nearby, full-scale custom-car show. Manufacturers such as Jet Hangar Hobbies* (JHH) and Golden West Models* were represented by talented pilots who thrilled spectators by performing breathtaking maneuvers with their high-performance model jets.

CROWDED SKIES

This event was open to all AMA members with approved ducted-fan or turbine-

Fifty Years of Flying Experience

The San Fernando Valley RC Flyers is a long-established model airplane club that is currently celebrating its 50th anniversary. Monthly meetings are held at a local community center where members can share modeling advice and enjoy one another's company. Guest speakers and industry representatives are often invited to answer modeling questions and provide technical advice.

The Apollo 11 field is open from dawn to dusk. No-cost flight lessons (with club trainers) are always available, and they'll even let you fly their planes! Visitors are always welcome to participate in club functions. To help ensure the hobby's growth, the club also heavily emphasizes youth participation. If you live in Southern California and are looking for an innovative, fun group of hobbyists to fly with, look up the Valley Flyers.

powered aircraft. More than 20 pilots were registered. A flight log was not kept, but jets were airborne almost continuously. Wind gusts of 50mph provided some excitement but didn't ground the jets; takeoffs and landings were nail-biters, though.

Each day began with an open flying session followed by time trials to find the fastest jet in the ducted-fan and turbine classes. A radar gun was used to measure top speeds in level flight.

When the time trials had finished, all the jets were lined up on the center taxiway so spectators could get a closer look at them and talk to the pilots. The "Parade of Jets" was easily the most popular event. All the pilots answered questions enthusiastically and were more than willing to discuss their models in detail.

EXPERT ADVICE

A lot of big names in modeling were there, and that made the Rally even more special. Golden West Models precision turbine engines powered many of the jets, and company spokesmen Bob Wilcox and Tad Krzanowski were there; they logged many flights and performed solo demonstrations during lunchtime, too. Valley Flyer member and racing legend Jay Replogle of San Clemente, CA, attended again; he flew a K&B*-powered F-15 Eagle. Jay was a big hit with the spectators and the other pilots.

Retired USAF Col. Robert E. Thacker has been in the hobby for more than 80 years. He can't fly real jets any more, so he flies the next best thing.

JHH owner Larry Wolfe also dropped by to demonstrate his company's new FJ-3 Fury. It's powered by a K&B prototype .48 engine and is one of JHH's new fan offerings. Larry has provided scale "special effects" models and technical advice to the movie industry; his jets were featured in "Top Gun," "Iron Eagle" (1 and 2), "Fire Fox" and many others. Next time you see a movie that has jets and lots of pyrotechnics, pay close attention; they might be models from JHH!

UNTIL NEXT YEAR

The 12th Annual Valley Flyers Jet Rally was a huge success, not only because it introduced the hobby to hundreds—perhaps thousands—of spectators, but also because it is one of the few remaining events on the West Coast dedicated to ducted-fan and turbine-powered model jets. As always, events such as these could not be held without the help of many people. Special thanks to all the pilots, sponsors, workers and others who helped make this rally possible. Airtronics*, Hobby Shack*, Jet Hangar Hobbies, Jet Pilots Organization, Robart Mfg.*, Sky Hobbies* and all the members of the San Fernando Valley RC Flyers should be recognized for their efforts.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

George Dominguez and his son Frankie hold up their scratch-built, approximately 1/3-scale replica of a USAF SR-71. Two ducted fans power this model, but several flight systems were not yet operational, so it did not fly. George is actually working on a 1/2-scale powered by two turbines. He hopes to have both of them running by the next Rally.

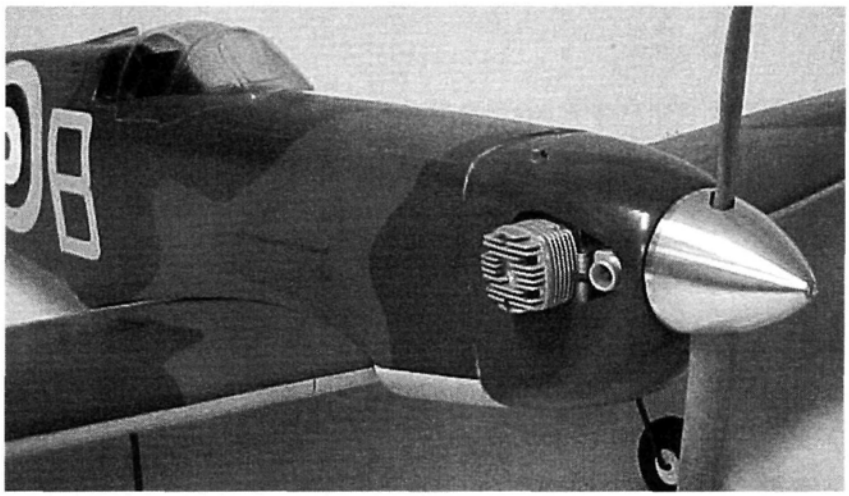
This beautiful Jet Hangar Hobbies A-7D Corsair II is owned by Francisco Buelna. It won "Best Military Scale" at the 1998 Rally.

Left: one of the F-16s that assaulted the skies during the Rally. Right: here's Jason Sones's Golden West Models-powered BVM* Maverick Pro in action. It was one of the fastest jets at the event.

MODEL AIRPLANE NEWS
HOW TO

Custom-Fit your Cowl

by Rick Bell

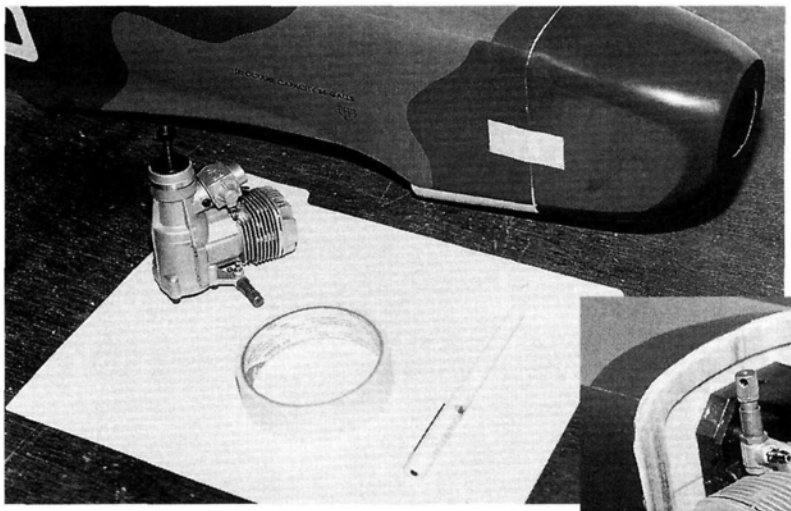


PHOTOS BY RICK BELL

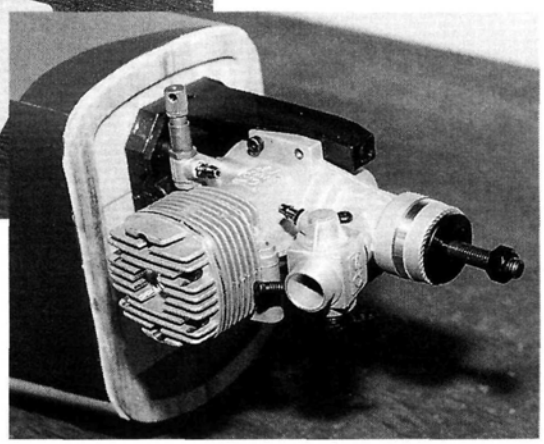
A neatly cut and trimmed engine cowl enhances any model's looks. Here's a Kyosho ARF Spitfire.

10 simple steps to a perfect installation

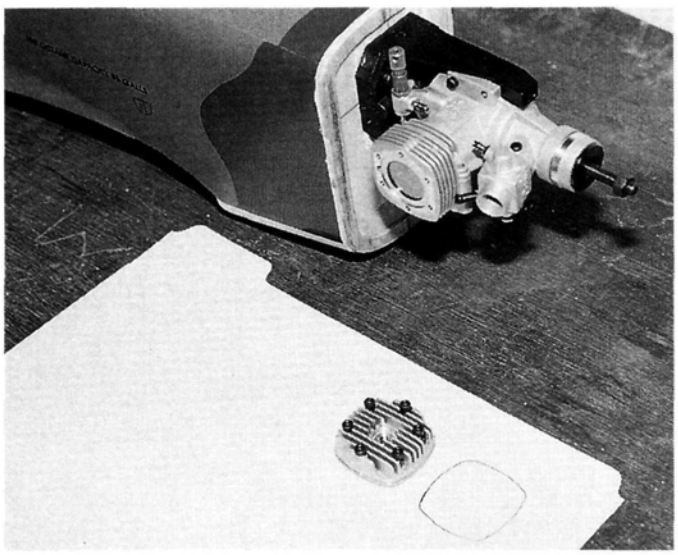
In the past, one of the most challenging tasks for me when building a model airplane kit was cutting the engine and needle-valve holes in a cowl. I often put the cowl into place, said, "This looks about right" and then cut away until I had a hole through which the engine would fit. Forget about making the needle-valve hole; that was a real shot in the dark, and my results were usually less than perfect; I even ruined a few cowls. Sound familiar? Following the technique shown in this article will all but eliminate the chance of making mistakes and will ensure great results every time. Interested? Read on!



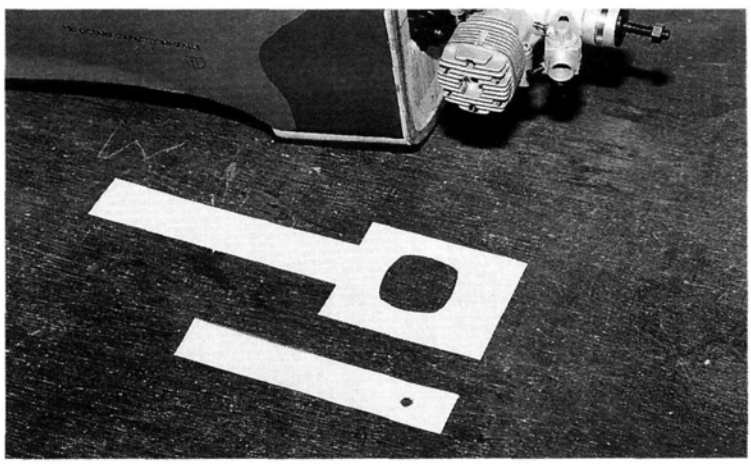
1 You'll need only a few items: a fuselage with a cowl ready to be added, your engine, some thin card stock (a manila folder works well), tape and a felt-tip pen.



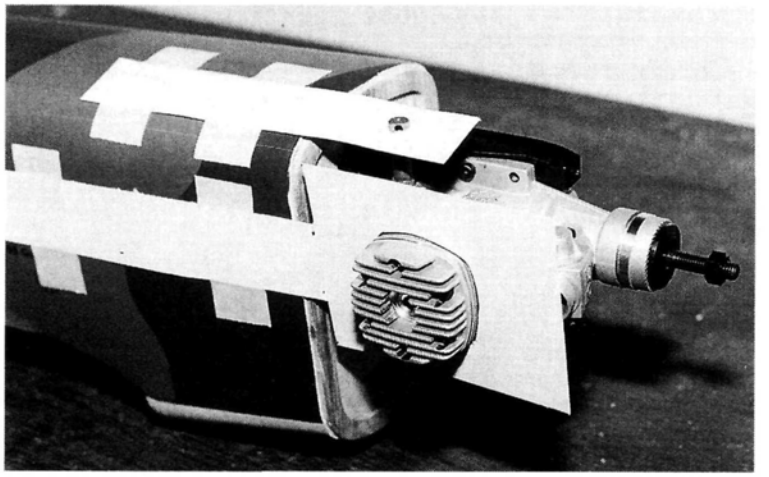
2 Before beginning, mount the engine as specified in the kit's instructions. Make sure that the thrust line is in the proper place so that the crankshaft exits from the center of the cowl. Then spinner alignment will be almost foolproof.

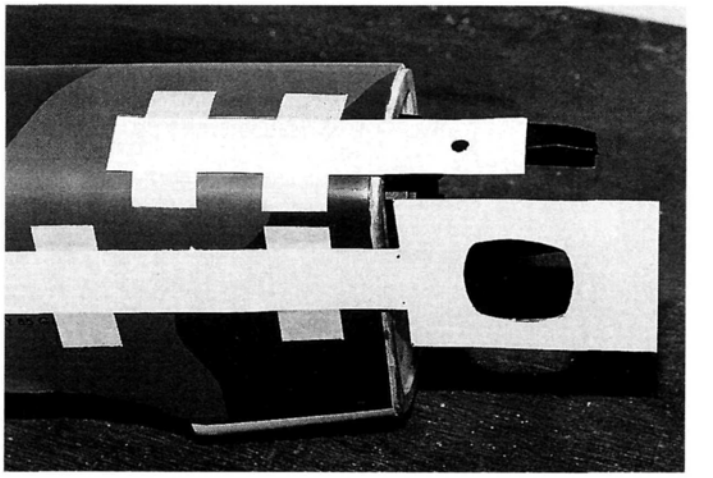


3 Remove the head from your engine, and trace around it on the card stock as shown. When you've done that, reinstall the head, being sure to properly torque down the bolts in a "crisscross pattern."

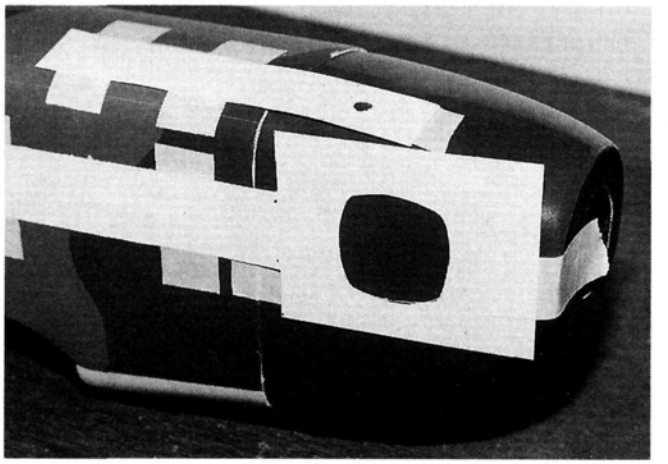


4 Next, cut out the opening for the engine in the card stock using the tracing you just made, and then cut your pattern out, adding a long "handle." Make a separate pattern for the needle valve using the same method as for the engine.

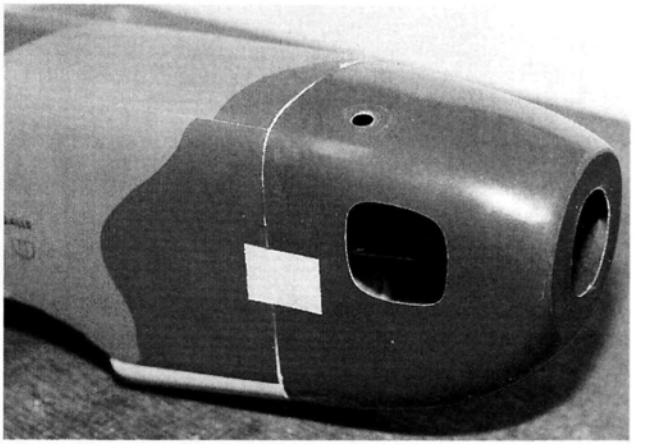




5 Tape the patterns onto the fuselage, making sure they fit over the engine and needle valve as shown. Place the tape back far enough to allow you to lift and bend the patterns away from the engine and cowl.

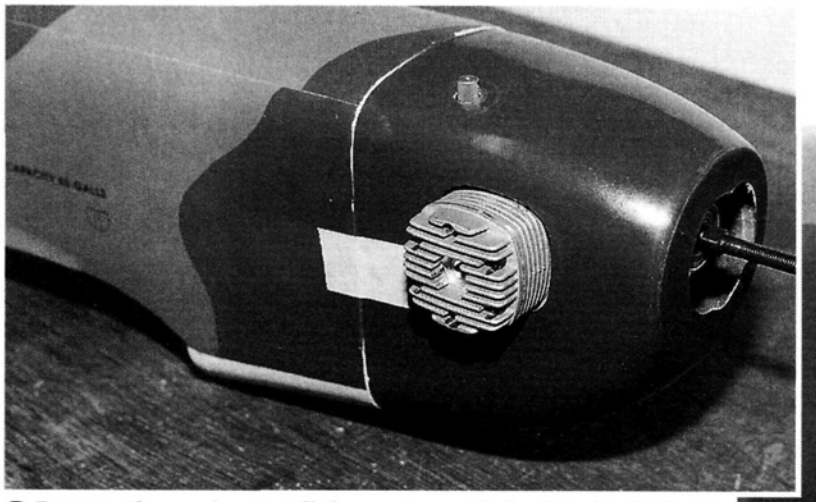


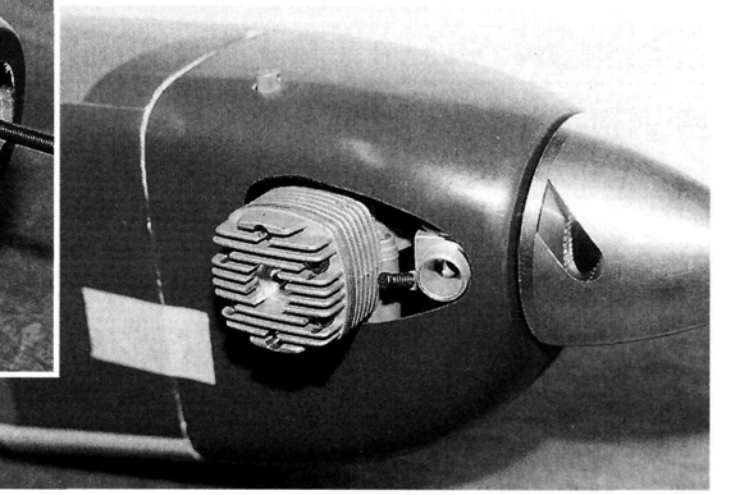
6 Remove the engine from the mounts, but leave the patterns taped in place.



7 Tape the cowl into place and tape the patterns to the cowl. Now you know exactly where to trace the openings for the engine and the needle valve; simply trace their positions onto the cowl with a felt-tip pen.

8 Remove the cowl and cut out the openings using your favorite method. If you cut fiberglass using a Dremel* tool, be sure to wear the proper protection. The photo shows how your cowl should look after you've finished cutting.





9 Remove the cowl, reinstall the engine, and check its fit. Make any necessary adjustments. As you can see in the photo, the fit that you'll get using this method is almost perfect.

10 Finally, you have to enlarge the opening to ensure proper clearance around the cylinder; also make adjustments for the carburetor if necessary. In this installation, I had to trim the cowl more to provide the proper clearance for the carburetor.

This technique is simple, quick and easy, and it consistently produces great results. Happy flying!

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✦

by Dave Gierke

Erickson MCC FE-120

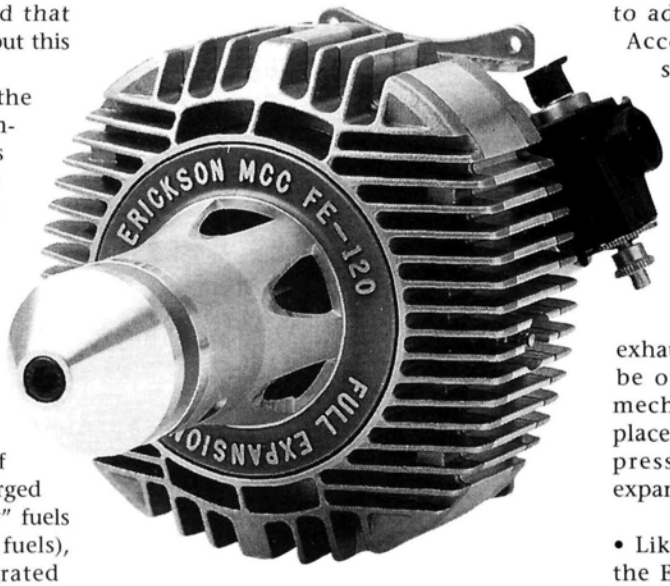
My first glimpse of the Erickson* engine came at the 1997 Toledo show. Although I'm six-foot three, I had difficulty seeing over the heads of modelers pressed four-deep around the booth. Initially I thought, "Aha; another rotary-combustion engine—a larger O.S. Wankel." Although it looked Wankel-ish on the outside, I soon learned that all similarities ended there! After Erickson Motors general manager Jeffrey Erickson had finished his presentation, I was convinced that "RPM" readers deserved to know about this unique engine.

Frederick L. Erickson invented the MCC (migrating combustion chamber) engine in 1969. To continue its development, he formed Engine Research Associates Inc. (ERA) of Fort Wayne, IN, two years later. In 1996, ERA formed Erickson Motors to market the MCC FE-120 to RC model aircraft enthusiasts.

Erickson has secured contracts from the Army, Navy, Department of Energy and Small Business Innovative Research for engines ranging from 1 to 50bhp. Some of these were sophisticated, supercharged diesels that ran on so-called "heavy" fuels including JP-5, 8 and 11 (turbine fuels), while others were naturally aspirated spark-ignition models. The Navy requires these relatively safe, low-volatility fuels for its unmanned aerial vehicles and other onboard applications such as electric generators. (Gasoline is prohibited aboard ship because of its volatile nature.)

THE ERICKSON IS DIFFERENT

• The MCC engine requires a high-torque starter motor. Erickson explains, "The chambers used for full expansion while operating under its own power are initially used to start the engine. These chambers create a [partial] vacuum to induct the fuel/air mixture into the combustion chamber. This suction work must be supplied by the starter motor. Since the expansion volume is about 3.5 times the swept intake volume, more work [from a larger starter] is required to charge the combustion chamber. Once the engine is running, these chambers convert from pumping chambers ... to power chambers."

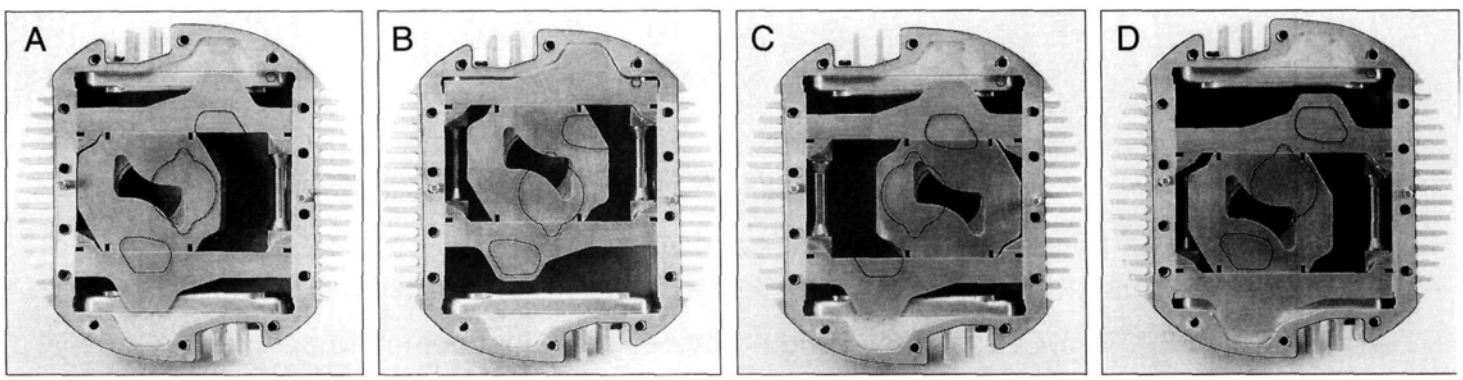


• The MCC engine requires more cooling fins than a conventional engine. Erickson explains that conventional engines release hot, tail-end gases through the exhaust to avoid performing negative work on the mechanism, therefore, " ... since the full-expansion engine [uses] these gases down to atmospheric pressure, more heat is retained by the expansion chamber walls." He then speculates, "The additional energy absorbed by the engine block results in higher torque ... from the crankshaft, resulting in an overall increased thermal efficiency."

• Because the engine doesn't have a conventional exhaust note, it's more difficult to adjust the air/fuel mixture by ear. According to Erickson, "The engine sounds about the same when it is firing as when it isn't." With practice, however, an operator can tell when the engine is rich, lean, or just right.

• The MCC has an unusual sequence of events within the cycle: induction, compression, exhaust and power. Although the exhaust and power operations appear to be out of order, the engine's unique mechanical action allows this to take place without altering the critical compression, ignition, combustion and expansion operations.

• Like a twin-cylinder, 2-stroke design, the Erickson fires twice per revolution. But because the air/fuel mixture is inducted directly into the combustion chamber and exhaust gases are pumped out, as in a 4-stroke design, the engine exhibits characteristics of both types. Exhaust gases can be pumped out of the engine against high backpressures without contaminating the fresh induction charge (a common occurrence with 2- and 4-stroke designs).



A. Cycle process: position 1. Combustion expansion and start of induction. B. Cycle process: position 2. Continue expansion induction. C. Cycle process: position 3. Compression, exhaust and start of primary expansion. D. Cycle process: position 4. Exhaust complete, with secondary expansion in process.

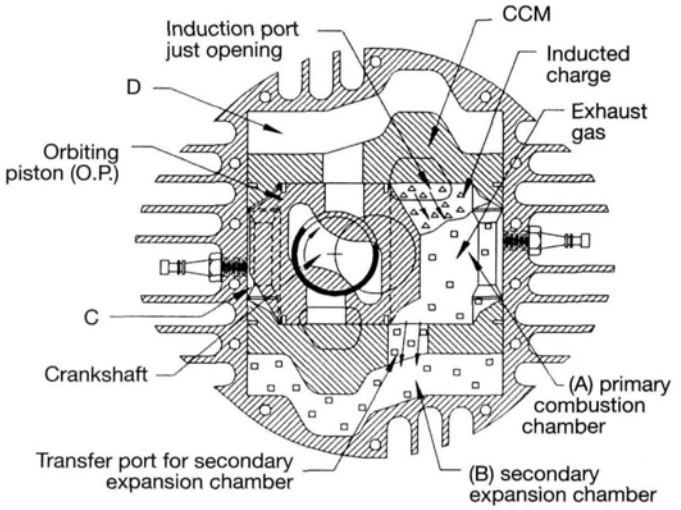


Figure 1. Combustion expansion and start of induction

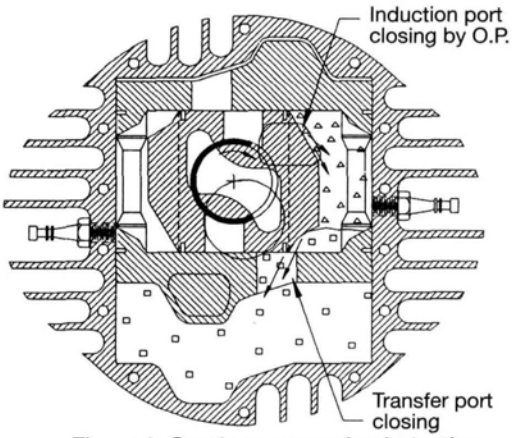


Figure 2. Continue expansion induction

HOW IT WORKS

The full-expansion (FE) cycle version of the MCC engine is illustrated in Figures 1 through 4 and photos A, B, C and D on the preceding page. These views are from the rear of the engine and show a clockwise crankshaft rotation. The air/fuel mixture is indicated by triangles, and the expanding exhaust gas is shown by squares. There are four variable volume chambers: A, B, C and D, formed within the power block by the orbiting piston (O.P.) and combustion chamber member (CCM). The right combustion chamber (A) operates with the secondary expansion chamber (B). Likewise, the left combustion chamber (C) operates with the upper secondary expansion chamber (D). Since both pairs of chambers operate independently, the engine is classified as a twin. Both pairs of chambers operate exactly the same, so only the operation of one pair of chambers is explained.

The engine's mode of operation is called "suction induction dual expansion" (SIDE). Figure 1 and photo A show that induction of the air/fuel mixture begins as the induction port opens. The suction is caused by the continued expansion of the gases to a point below atmospheric pressure. This is achieved by the dual expansion that is performed by chambers A and B by means of a transfer port in the CCM. The total expanded volume must be 3 to 3.5 times the initial compression volume of chamber A for the two chambers to reach atmospheric pressure. This happens at a point where chamber A has reached its maximum volume and chamber B has reached its ½ volume position. As chamber B continues to expand, the pressure drops below atmospheric pressure. This causes the suction that pulls the air/fuel mixture into chamber A as the exhaust gas products are pulled into chamber B ahead of it.

As chamber B reaches its maximum volume, as shown in Figure 2 and photo B, it has pulled practically all of the exhaust products from chamber A into chamber B. At the same time, the exhaust gases in chamber A are replaced by fresh new air/fuel charge. Now the piston rapidly closes the induction and transfer ports. When both ports are closed, chamber A begins compression of the new charge.

In Figure 3 and photo C, the air/fuel mixture is ignited slightly before top dead center. This begins the initial combustion and primary expansion in chamber A. At the same time, the exhaust gases in chamber B are pushed out of the engine through a port in the CCM and a port in the orbiting piston. Exhaust gases exit through the piston and then out the rear exhaust manifold. The exhaust is quiet and cool because most of the available thermal energy has been used to perform work within the engine.

Exhaust gases from the Erickson engine can be ejected at a high backpressure without affecting the induction process. In conventional piston engines, high backpressures push hot, spent exhaust gases into the induction system, contaminating the fresh air/fuel charge; this compromises performance. The MCC engine pumps exhaust gases out at a different time, which doesn't influence induction. The only performance loss attributed to the engine is the power required to pump exhaust gases against the encountered backpressure. This gives the MCC engine the ability to eject exhaust gases through small tubes over long distances. This feature is not practical with the standard piston engine.

Figure 4 and photo D illustrate the completion of the exhaust event and the start of the secondary expansion process in chamber B. This dual expansion process begins when the transfer port in the CCM is opened by the orbiting piston. Dual expansion pushes the orbiting piston clockwise as the CCM moves upward. Chambers A and B will expand until the pressure in the chambers falls below atmospheric pressure, as shown in Figure 1. As the CCM moves upward, it will open the induction port and a new cycle will begin.

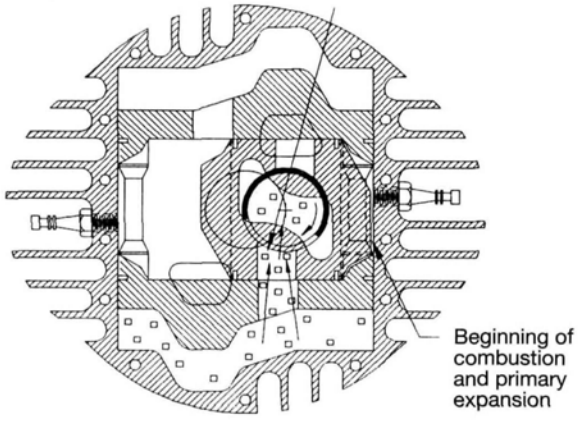


Figure 3. Compression, exhaust and start of primary expansion.

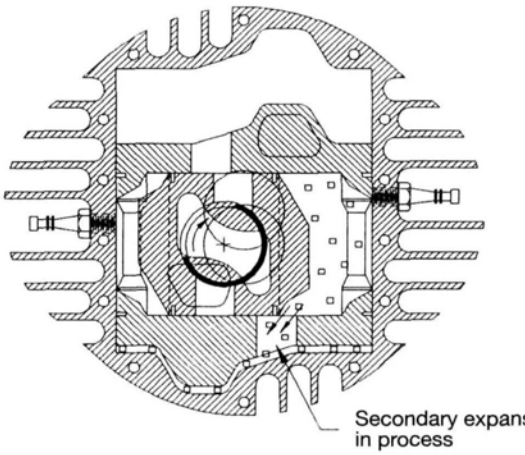


Figure 4. Exhaust complete, secondary expansion in process

SPECIFICATIONS

Engine name: MCC FE-120

Manufacturer: Erickson

Type: twin-combustion 1.20ci, 19.7cc

Engine weight with mounting brackets: 38.1 oz.

Fuel: glow fuel containing 15% nitromethane and 18% synthetic oil

Practical rpm range: 2,000 to 7,000

Reliable idle rpm: 1,800

Barometer (test): 29.39 (actual)

Temperature (test): 65° F

Wet-bulb temperature (test): 59° F

Peak bhp: 1.22 @ 6,400 (corrected)

Peak torque: 185 oz.-in. @ 6,300

Bhp/lb.: .51

Bhp/ci: 1.02

Torque/lb.: 78

Torque/ci: 154

Fuel consumption @ wide-open throttle: 1 to 1.5 oz./min.

Dimensions: 4.42 in. high, 4.33 in. wide, 5.5 in. long

Propeller nose-bolt size: ¼-28x2 in.

List price: $459

Features: cast-aluminum alloy and steel casting construction; case-hardened steel crankshaft supported by three ball bearings; high silicon content aluminum-orbiting piston and CCM; composite nickel-carbide coating on wear surfaces of the CCM. Engine mount, pressure fitting for operating pulse-type regulating pump, Fox Mfg. long glow plugs, spinner, exhaust tube and tools included.

Hits

- First-class production from an American engine manufacturer.
- Smooth, quiet, low-speed operation without a muffler.
- Handles very heavy propeller loads for its displacement.
- Excellent fuel economy.

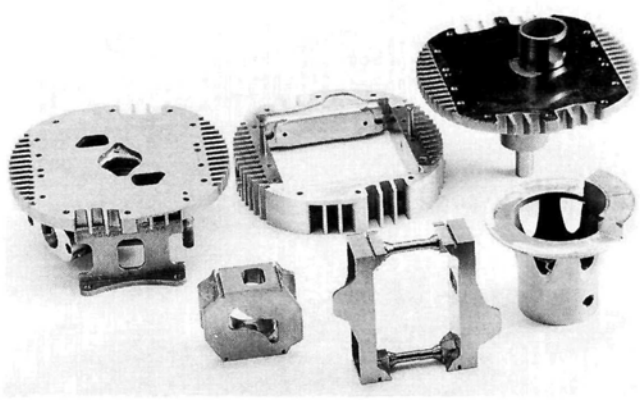
Misses

- High starting torque required.

FUEL

The only acceptable fuel for the Erickson MCC is methanol-based glow fuel containing 100 percent synthetic lubricant. All other fuels, including gasoline, are strictly forbidden. Because of its relatively high operating temperature, castor oil would soon varnish and carbon the inner workings of the Erickson engine. Hydrocarbon fuels, e.g., gasoline, run too hot for this design, while methanol-based glow fuel helps to lower engine temperatures by vaporizing in the induction system. Known for its high heat of vaporization, methanol is responsible for what some experts refer to as liquid cooling.

Synthetic lubricants leave few deposits inside the engine, but they don't possess the protective, high-temperature properties of castor oil. Operating experience with conventional piston engines has shown that synthetics perform satisfactorily when a rich air/fuel ratio is fastidiously maintained. In conventional engines, lean mixture settings with synthetics have proven catastrophic to mechanical components. Synthetic lubricants burn at a lower temperature than castor oil without the benefit of its protective varnish film. Most experts believe that a lubricant stops being a lubricant when it burns.



Major components of the Erickson MCC FE-120 engine.

ACCESSORIES

Although a fuel pump isn't provided, Erickson recommends using one to ensure consistent fuel flow to the carburetor. A pressure tap is provided at the rear of the engine, but I found no difficulty starting or running the engine on suction feed for all break-in and dynamometer runs. For flying, I would use a Cline* Regulator in conjunction with engine pressure to ensure adequate fuel flow.

Erickson states that using any glow plug other than a Fox* R/C Long " ... could damage the engine." This is a surprising statement until you realize that some plugs may contact the CCM. This isn't a hot plug/cold plug problem, but a case of not inflicting severe mechanical damage.

Since there are two glow plugs to light, Erickson recommends two 1.2V, 1400mAh Ni-Cd cells. For my testing, I used two glow drivers operated from a 12V, sealed, lead-acid battery.

Erickson recommends using the Sullivan* Dynatron 12 to 24V starter. It should have the capacity to turn the propeller at a minimum of 900 to 1,000rpm when the engine is cold.

MOUNTING

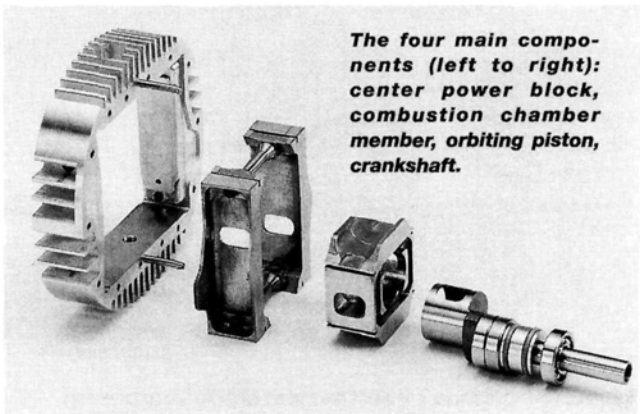
The engine must be mounted with its glow plugs in the horizontal position. If it isn't, the lower glow plug will flood when the engine is turned over.

Although the engine requires adequate cooling, it may be mounted inside a cowl as long as the airflow past the cooling fins isn't restricted.

Note: since the MCC FE-120 engine has a different exhaust sound than traditional engines, it's difficult to set the primary needle valve by ear; I relied on the tachometer. Furthermore, Erickson suggests that prolonged full-throttle operation on the ground or test stand should be avoided, since the cooling provided by the hub area of the propeller isn't adequate. Only airborne operation provides the extra air movement to properly cool the engine at full throttle. I found that the Erickson operated well within acceptable temperatures throughout all of my test stand and dynamometer runs, some of which lasted for 3 minutes. At no time did engine temperature exceed 325 degrees F.

STARTING PROCEDURE

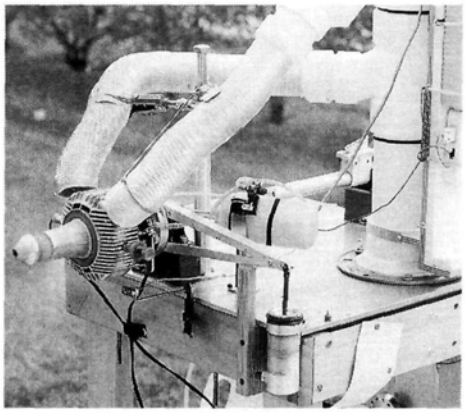
- Mount a balanced 16x14 or 18x12, 2-blade propeller.
- Carburetor adjustment: main needle, 1.3 turns from closed; idle disk at about 8 degrees rich (without air cleaner).
- Set the throttle about ⅓ open.



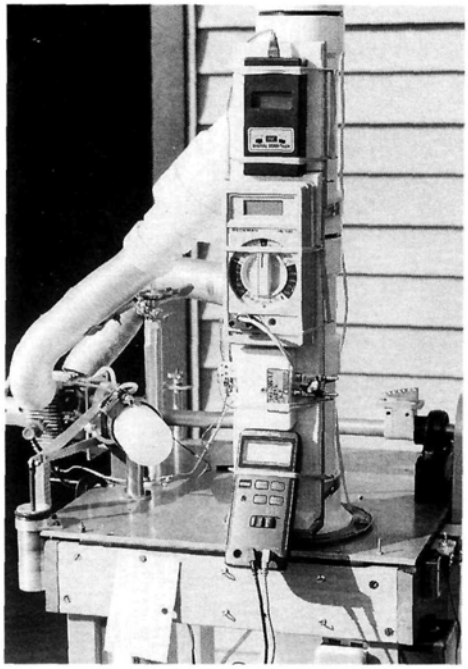
The four main components (left to right): center power block, combustion chamber member, orbiting piston, crankshaft.

• Choke the carburetor venturi with one counterclockwise rotation of the propeller.
• Attach glow-plug batteries to each glow plug.
• Spin the propeller counterclockwise with the Dynatron starter. The engine will probably start and stop a couple of times because the carburetor has been set for a hot run. The engine should then run, picking up speed as it warms up. After about 30 seconds, it should warm enough to disconnect the glow power. If the ambient temperature is below 65° F, the main-needle valve will probably need to be richened about ⅓ to ½ turn.
• To check the high-speed needle-valve setting, advance the throttle fully for a few moments. A rich mixture causes a rough, shaking operation, while a lean mixture normally causes the engine to backfire. Normal operation is achieved when the engine is first adjusted to its highest rpm and then backed off about an ⅛ turn toward the rich side. This last bit of advice is similar to that given by producers of conventional engines.
• After about one minute of warmup, the engine should idle down to about 1,800rpm and transition to full power (about 6,300rpm) without hesitation. The factory claims that the idle should settle down to about 1,600rpm after complete break-in has been accomplished.

Note: if the engine seems to be running too slow and will not speed up when leaned out, then one of the glow plugs could be flooded. To correct this, the engine must be stopped, the plugs removed, blown dry and tested to make certain they are still glowing brightly. After disconnecting the fuel line, spin the engine with the starter to blow out excess fuel from the combustion chambers. Warning: stay clear of both sides of the engine when blowing out excess fuel. Replace the plugs, fuel line and glow-plug batteries. Repeat the starting procedure.
• If the engine backfires at low speed, richen the carburetor idle disk setting by about 10 degrees at a time until the backfiring stops. If the engine backfires at full throttle, richen the high-speed needle in a similar manner.



Erickson MCC FE-120 running at speed on torque reaction dynamometer (note the additional cooling provided by a squirrel cage blower and delivery ducting). The MCC FE-120 provides quiet, mufflerless operation.



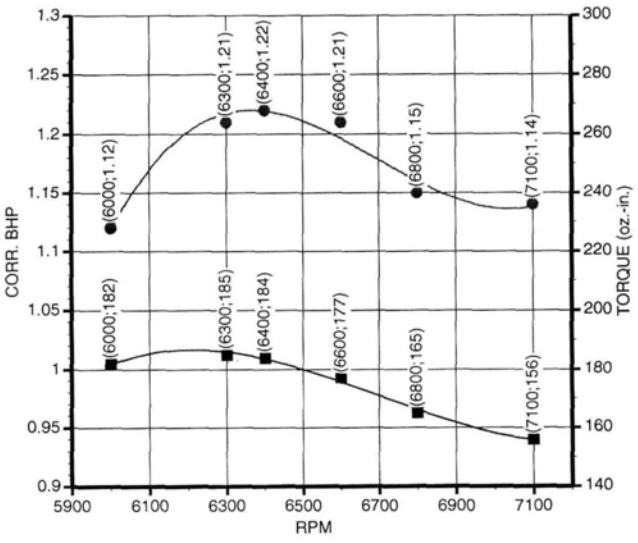
Dynamometer instrumentation (top to bottom): tachometer, chamber member temperature meter, thermocouple power supply and processing unit, digital voltmeter/torque meter.

BREAK-IN PROCEDURE

The Erickson MCC requires special break-in before it's ready for prolonged in-air operation. I followed the detailed instructions implicitly for more than an hour of running on the test stand. I was finally satisfied with the MCC-FE's mechanical condition when it held a full power setting for 20 seconds without losing rpm.

Erickson advises flying the engine in a model with enhanced cooling to complete the break-in process. As mentioned previously, they recommend using a pump to ensure adequate fuel delivery to the carburetor and the primary needle valve set on the rich side of peak power. Three-quarter throttle is recommended for takeoff; once in the air, Erickson suggests flying out the tank of fuel at ½ throttle. Allow the engine to cool between runs and repeat four to six times.

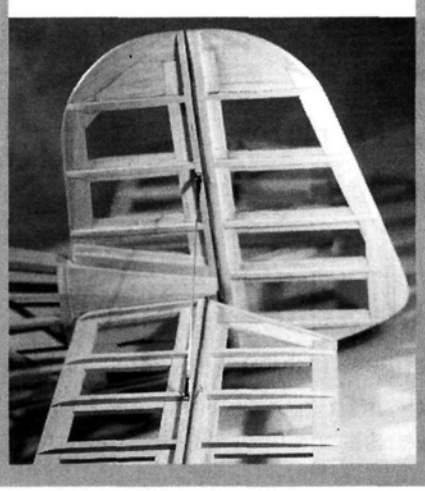
If the engine operates without a tendency to seize, fly the plane for short durations at ¾ throttle. If it loses power, kick back to ½ throttle, allowing the engine to cool. Repeat this type of operation until the engine will run at ¾ throttle without losing power. Erickson claims that the engine will continue to improve in performance as it is operated after the initial break-in period and concludes, "It may take several hours of flying for the engine to reach its optimum performance level."



DYNAMOMETER TESTS

After mixing a batch of my standard fuel (without the castor oil), I mounted the engine to the dynamometer for break-in. Here, I could take advantage of the dyno's auxiliary cooling system. Next, I filled the tank, mounted a

Rpm	Torque	Corrected bhp	Bhp	Correction factor	Conditions	
5,900					Wet bulb (°F)	59
6,000	182	1.12	1.08	1.04	Dry bulb (°F)	65
6,300	185	1.21	1.16	1.04	Barometric pressure (Hg)	29.39
6,400	184	1.22	1.17	1.04	Vapor pressure (Hg)	0.4
6,600	177	1.21	1.16	1.04		
6,800	165	1.15	1.11	1.04		
7,100	156	1.14	1.10	1.04		
7,200						



Propeller performance (provided by Erickson)

Propeller	Prop mfr.	Rpm	Thrust (lb.)	Decibels
18x10	Moki	6,900	14	95
18x10	Zinger	6,200	14	95
15.5x12 (4-blade)	APC	6,400	12.5	96
16x8 (3-blade)	Graupner	7,300	12	96
17x10N	APC	7,000	12	96
16x14	APC	6,400	11	94
17x12N	APC	6,600	10.5	96
13.4x13.5 (3-blade)	APC	7,300	9	98

Note: these tests were performed with an open exhaust (no muffler). Sound readings were taken at 3 meters.

Propeller performance (author's tests)

Propeller	Prop mfr.	Rpm	Decibels @ 3 meters
16x8	APC	7,100	100
16x10	APC	6,800	96
15x12	APC	6,600	96
16x12	APC	6,400	96
16x14	APC	6,300	93
18x12	APC	6,000	95

previously balanced APC 16x14 2-blade propeller and attached a thermocouple to the rear power block. Following the procedures outlined above, I engaged the starter and depressed the start button. I immediately realized that a firm grip and considerable axial force was necessary to prevent slippage between the starter cone and the engine's shaft nut. Frank Vassallo's assistance was required to push against the rear of the dyno to prevent it from tipping over during starting! Fortunately, after the first few starts, the amount of force required decreased somewhat as the engine loosened up. A few words of caution: when starting this engine on the front of your model, be certain you have a helper with a solid grip or a great holding stooge.

After break-in, I prepared for peak-power dynamometer testing. Anticipating relatively high-torque loads, I added weight to the bottom of the pendulum and recalibrated the unit. The Erickson engine proved to be a dyno-friendly test subject. Torque data was collected for six load points between 6,000 and 7,100rpm. Maximum fuel consumption turned out to be a pleasant surprise. Operating at slightly more than one fluid ounce per minute at peak bhp rpm, the engine is very fuel efficient. When compared with conventional engines by using the specific fuel-consumption technique (pounds of fuel per bhp-hour), the Erickson still does well.

I observed that the engine operated more smoothly and was easier to needle as the propeller sizes and subsequent loads were increased. Although an 18x12 APC is considered to be a very large load for any conventional 1.2ci engine, I got the feeling that the Erickson could probably handle 20-inch-diameter propellers.

Brake horsepower numbers are low, however. It's important to realize that because the Erickson operates at much lower speeds than conventional engines, its power is naturally less. Small engines obtain high power levels by running fast with ever-decreasing torque. Torque determines the propeller size that can be turned by the engine at a given rpm. As I've mentioned many times in the past, high rpm, high bhp engines use small propellers.

Although the Erickson produces good static thrust from a variety of propellers, many 1.2ci conventional engines do better with the same props. We know this because thrust is equal to the square of rpm increase (Th = rpm^2). Example: Erickson turns an APC 16x14 @ 6,400rpm while claiming 11 pounds of static thrust. Several conventional 1.2ci 2-stroke engines will turn the same prop @ 8,400rpm; 8,400 divided by 6,400 = 1.3125^2 = 1.7 times the static thrust, or 18.7 pounds (11x1.7).

In the final analysis, I believe that the Erickson 1.2 is best suited to scale and sport models that are not intended for relatively high-speed operation, where vehicle air drag requires exponentially higher propulsion horsepower.

Refer to the torque/bhp graph for detailed performance results; calculated performance statistics may be found in the specifications table.

CONCLUSIONS

Although power levels don't approach those of conventional 1.2ci 2-stroke designs, the design is ideally suited to smoothly turning very large propellers. Its exhaust sound intensity compares favorably with similarly sized, naturally aspirated 4-stroke engines, without resorting to a muffler. Since the Erickson is very frugal on fuel consumption and there are no detrimental effects from using lengthy exhaust extensions, the airframe can be kept relatively free of exhaust residue. This is not to be taken lightly; engine installation is a breeze when you don't have to deal with a muffler!

At $459, the Erickson MCC FE-120 represents a substantial investment for a 1.2ci engine. However, for those who take pride in owning a unique prime mover with enticing operational characteristics, this one's for you!

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

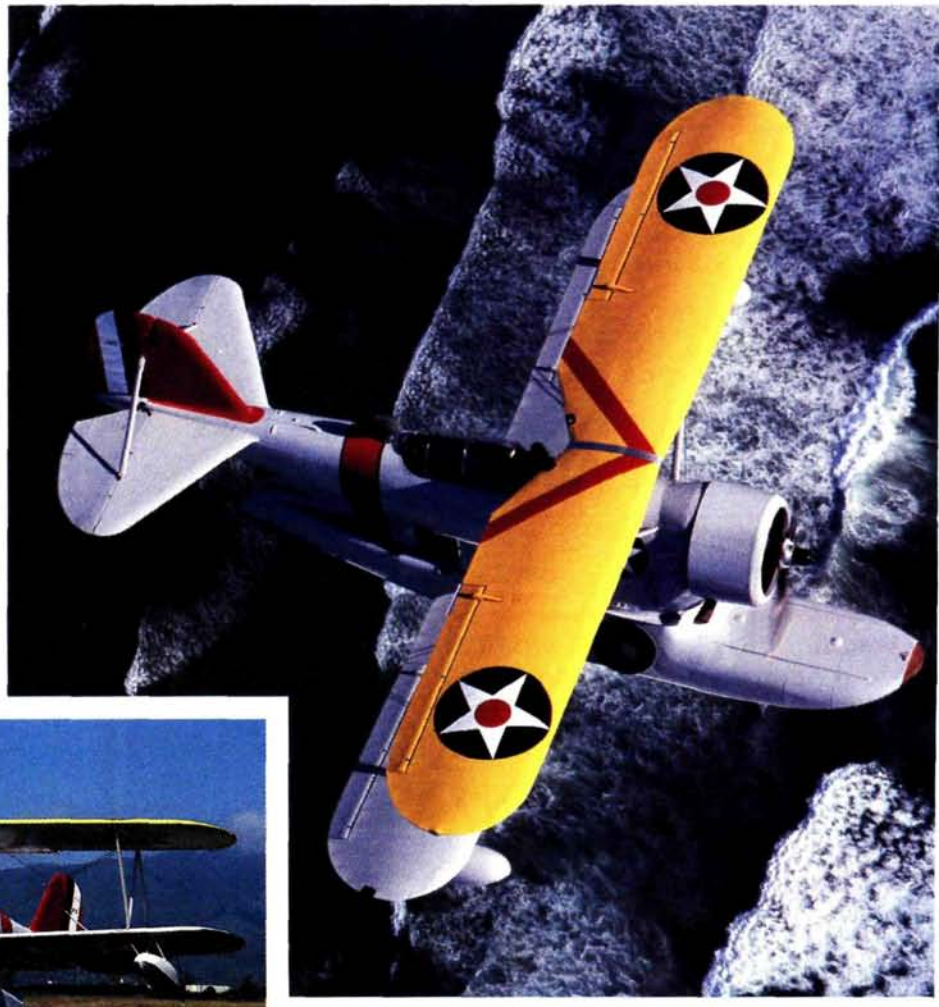
PLANES WORTH MODELING

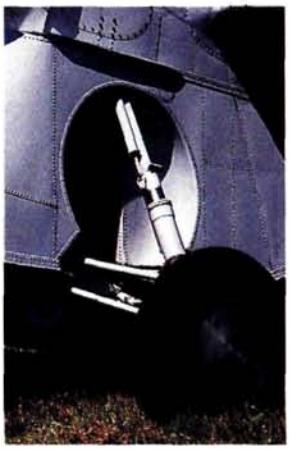
3-View Documentation for Scale Modelers

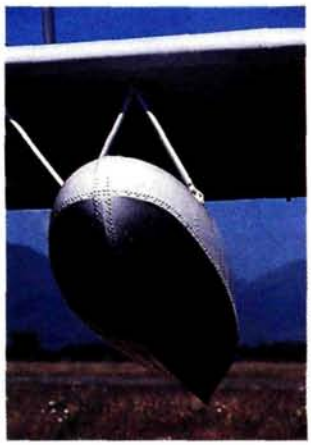
by Geoff Cozine

Grumman/Columbia J2F-6 Duck

The Grumman/Columbia J2F-6 Duck was first produced in 1944. It was designated "J" because it was used as a utility aircraft and was given photographic, target-towing, rescue, ambulance and other similar duties during the course of its service. With its retractable main gear and a tail-wheel that doubled as a water rudder, the Duck was versatile as to where it could land, and that made it a valuable asset to the U.S. Navy. There were two cockpits on the J2F-6, and both the folding door in the rear cockpit and the hatches on the outside allowed access to the lower compartment, which could hold an additional two passengers, a stretcher, or supplies and gear. The outside hatch served to speed the rescue of downed airmen.







PHOTOS BY BUDD DAVISSON

SPECIFICATIONS

Wingspan: 39 ft.

Length: 34 ft.

Height on wheels: 13 ft., 11 in.

Wing area: 409 sq. ft.

Loaded weight: 7,700 lb.

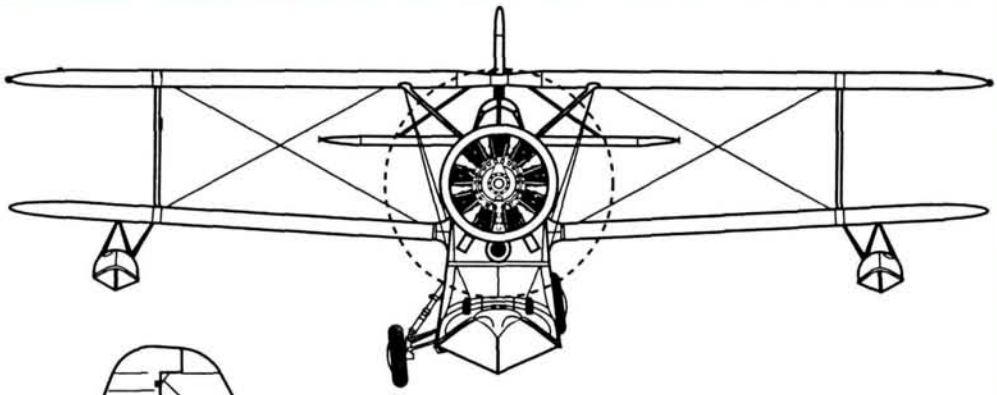
Maximum speed: 190mph

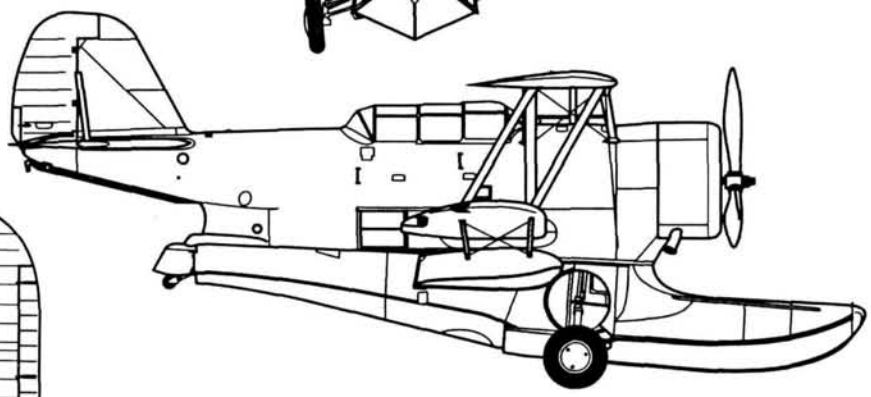
Powerplant: one 1,050hp Wright R-1820-54 Cyclone

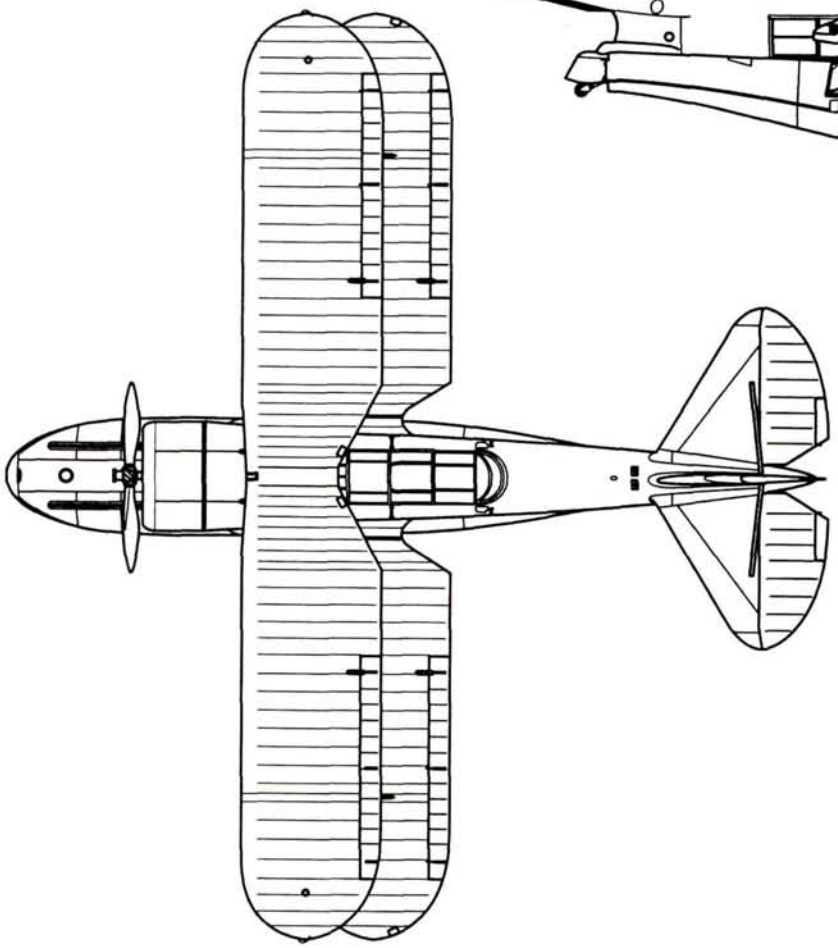
Armament: two 100 lb. bombs or two 325 lb. depth charges, one .30-caliber Browning machine gun

Range: 850 miles

Service ceiling: 20,000 ft.







DRAWINGS BY LLOYD JONES

The J2F-6 Duck was the last of the Grumman J2F line, which first appeared in 1933; 330 in all were made. It was actually built by Columbia, not Grumman, as were the other J2Fs because the Navy wanted Grumman to focus its efforts on fighter and torpedo planes. Among its accolades, the J2F-6, along with the J2F-5, was active well into the 1950s and was, with the exception of a few N3N primary trainers, the last biplane in the U.S. Navy. The J2F-6 was also the "star" of "Murphy's War," a movie shot near the end of WW II, in which Peter O'Toole's character teaches himself to fly an abandoned J2F-6 to exact vengeance on a German submarine for sinking his merchant ship. It also appeared in numerous other movies.

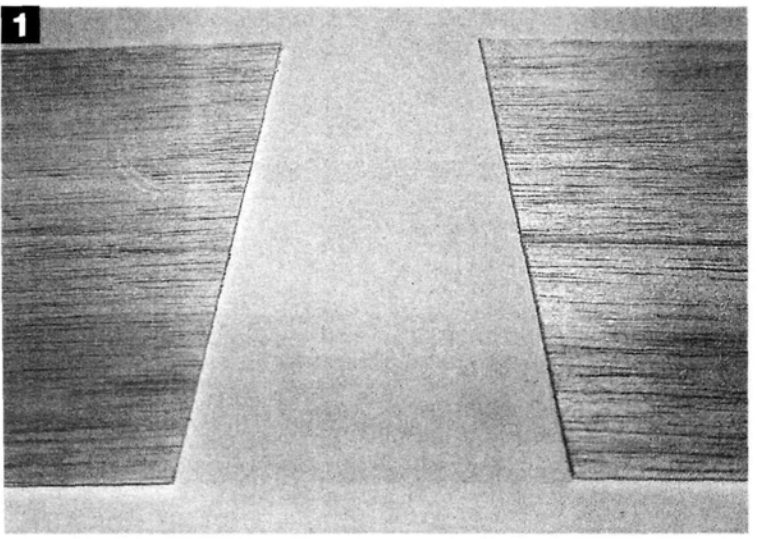
The J2F-6 is a unique subject that will challenge you, and when completed, you will have an astounding model that is capable of taking off and landing on either water or land with just the flick of a switch. ✈

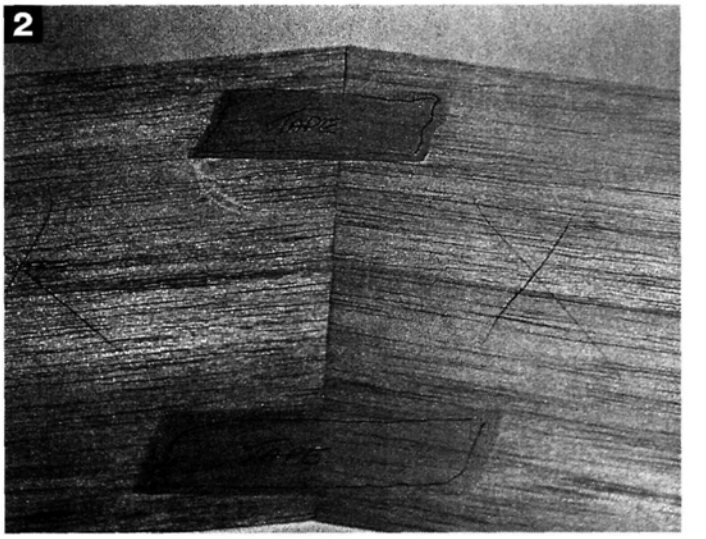
Edge-Join Balsa Sheeting

A simple method with great results

by Robert B. Lawson

A long time ago while I was learning my trade, a very experienced woodworker taught me this method of seamlessly edge-joining wooden pieces, and I have used it very successfully to join balsa sheeting. It is very simple; the most difficult part is ensuring that you have a clean working surface.

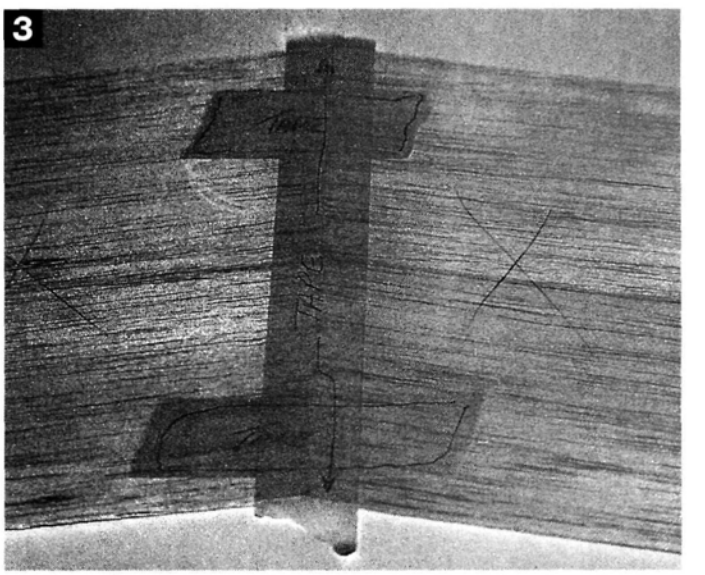




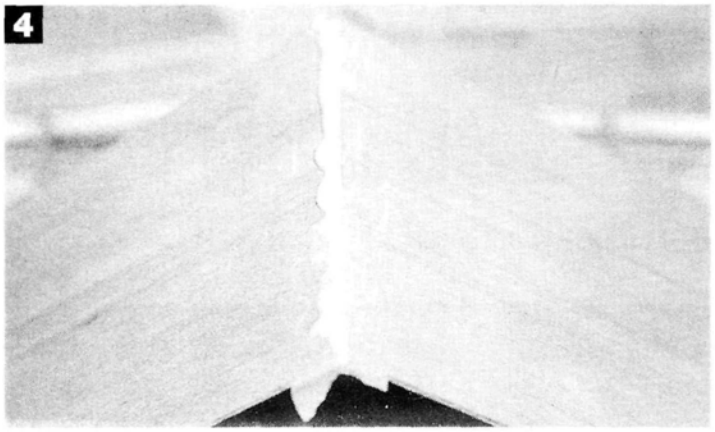
1 Please note that I joined balsa sheeting "with the grain." I then cut pieces at the appropriate angle to cover a horizontal stabilizer. Four joined pieces are shown here!

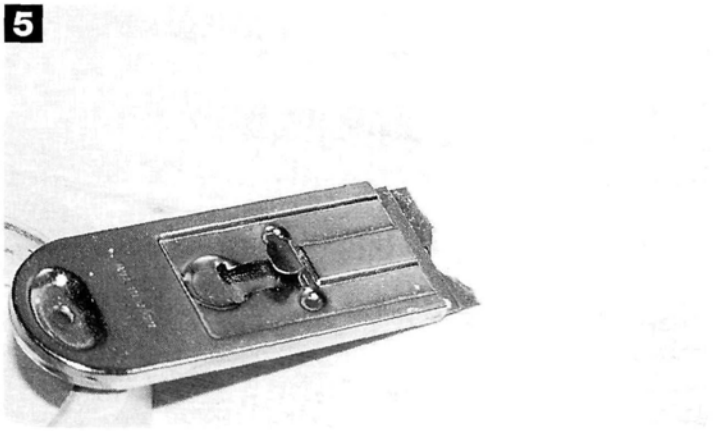
2 Very carefully sand and fit the edges to ensure a very tight fit. I use an absolutely flat sanding block or bar (depending on the length of the pieces) and very fine sandpaper. Remember that the quality of this fit will determine the quality of your finished joint. Work very slowly and methodically, and you will be proud of the result. I sometimes clamp the balsa between two aluminum plates that I know have true edges. Then, using 400-grit sandpaper, I sand the balsa flush with the plates; that's how I ensure that it will have straight, smooth edges. Sand and test-fit the pieces until you are satisfied, then mark the rear sides with an "X," and place a few pieces of tape across the joint. Be sure that the joint is tight and that the balsa pieces fit together well.

3 Next, completely cover the joint and the previously applied tape with another, longer strip of tape. Burnish it down to ensure a good bond, as this helps to reduce glue squeeze-out and will lessen the amount of sanding needed later.



HOW TO EDGE-JOIN BALSA SHEETING





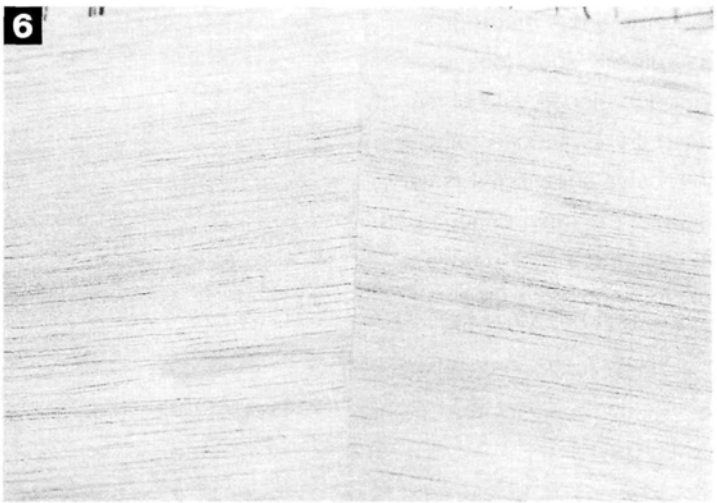
4 Turn the taped assembly over and fold it along the taped seam. Carefully apply glue (I use Titebond) to the joint, then place the sheeting on a clean, flat surface with the glue side up.

5 Use a razor scraper to remove excess glue from the untaped side of the seam. Place wax paper on your work surface, put the glued and scraped balsa on top of it, then cover that with an additional piece of wax paper. Finally, set a very flat and smooth panel on the top. Weight the panel down well to prevent the balsa from warping. Allow the glue to dry completely.

6 After the glue has set, remove the assembled balsa panel. You should have a tightly fitting joint. Now thoroughly sand the joint and remove the tape from the other side. Again, be extra careful to use a flat sanding block. For this article, I used four pieces of light and dark wood to show the joints better.

If you use this method to join sheeting, I know you will be impressed with the results. It's easy, and you'll love the time you save on sanding. Happy flying.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

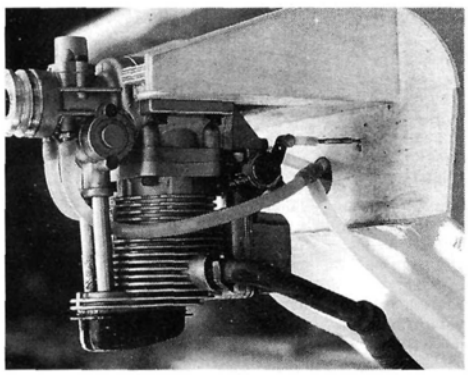


Gas or glow: which engine is right for you?

Gasoline-powered aircraft have become very popular over the years, and for good reason. A gradual shift toward larger models has occurred, and this, in turn, has stimulated the popularity of gas-burning powerplants. For a while, this niche was filled by large-displacement glow engines. I can remember when a .60-size glow engine was considered huge; then there was the .90, the 1.08, and so on. But today, we have many fine examples of gas engines designed and manufactured exclusively for RC.

There are many things to consider when you choose an engine type. The following are only my opinions; I'm sure you'll find exceptions. Glow engines are generally lighter, simpler, more powerful, cooler running and less prone to generate radio interference from the ignition system. Glow engines are also usually less expensive—not a bad case for using glow engines, right?

Wait; not so fast. If you want a really big glow engine, there is a price to pay. Compared with gasoline engines, glow engines are very fuel thirsty. For example, when running on glow fuel, my Infinity 140cc, in-line, twin-cylinder engine requires two, 32-ounce fuel tanks, and that was barely enough to make it through a complete flight at the TOC. In fact, a couple of times, I had to land with only one cylinder firing because of a lack of fuel. Executing the same maneuvers while running on gasoline, however, my 3W* 140 requires only one, 32-ounce tank, and it often lands with about a third of the fuel remaining.



This is the YS 1.20 mounted on the Pitts—a simple, light installation.

I have been told that, all things being equal, the fuel flow for a glow engine is 2½ times greater than it is for one that burns gasoline. Add to that the fact that glow fuel costs seven to 10 times more than gasoline, and it really begins to add up. By comparison, today's RC gas engines are quite powerful, economical and reliable.

Availability of certain parts is also an issue, as far as some of the bigger glow engines are concerned. Most parts for gasoline engines enjoy a relative "off-the-shelf" status, especially cylinders and pistons. Excellent carburetors, such as those made by Walbro and Tillitson, are also available for gas engines. These were designed for use with chain saws and have a built-in diaphragm pump. A pumper carb is great for model aircraft; you can place the fuel tank almost anywhere.

Here I am with two of my gas-powered aircraft: a 37-percent-scale, 3W 140-powered TOC CAP 232, and the new, ¼-scale Pitts ARF from Cermark powered by a Zenoah G-23. Both aircraft are excellent performers.

What could be better than two Pitts? I powered one with a G-23 and the other with a YS 1.20. This was a great opportunity to get a comparison between gas and glow-engine performance.

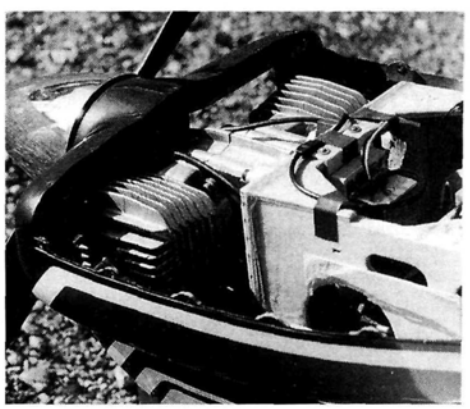
On smaller airplanes, however, the benefits of using a gas engine may not be worthwhile. Because of its ignition system, a gas engine requires a larger (and heavier) battery pack. Weight is always more critical with smaller airframes, and a cross-over point must be determined at which a certain size of gas engine is more favorable than a glow engine. This decision is an individual one and must be based on one's personal need for performance and economy.

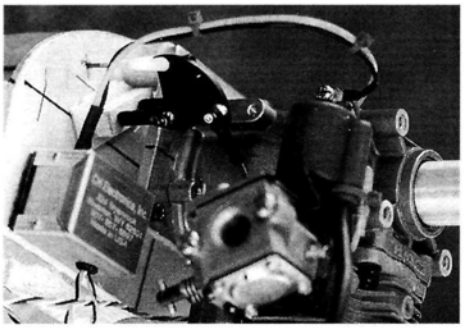
I have two Cermark*, Signature Series ¼-scale S-2B Pitts biplanes; one is powered by a YS* 1.20 4-stroke glow engine, while the other is powered by a Zenoah* G-23 gas engine. Both aircraft are very reliable, and both are excellent aerobatic performers. I can say that I enjoy flying both setups very much, but for competition, the YS 1.20 is clearly the more powerful engine. The Zenoah uses inexpensive automotive gas and has a great smoke system. The G-23 doesn't pull the model in a vertical line as well as the YS, but I love using it to fly fun maneuvers such as Lomcevaks and rolling circles (especially with that smoke system).

Another consideration is that the ball bearings in a glow engine tend to rust more easily than in a gas engine because the alcohol in glow fuel attracts moisture and requires the use of an after-run oil to prevent corrosion. A gas engine does not have this problem, as the oil mixed with the gas provides adequate protection. Also, because glow engines run cooler than gas engines, they do not generate as much smoke as their gas-fed cousins.

So in a nutshell, my advice is: the bigger the plane, the more reason you'll have to consider a gas engine.

Big, beautiful and reliable, the 3W 140 twin-cylinder gas engine in my 37-percent-scale CAP 232 is very, very powerful. It turns a Bolly 30x12 carbon-fiber prop.





This is the Zenoah G-23 installation. Note the CH* electronic ignition—clearly a more complicated setup.

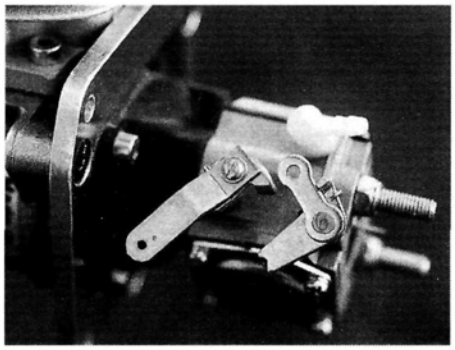
CARBURETOR LINKAGES

As I mentioned earlier, most gas engines are equipped with either a Walbro or a Tillitson carburetor. These carbs weren't originally designed for RC plane use. They have a self-contained fuel pump and an atmospherically controlled regulator. The pump system is very clever and works very well but sometimes can cause some grief. A small hole in the carb's front cover allows the pump to sense ambient air pressure so it can properly adjust the fuel-flow pressure to the needle valve. Sometimes, as the model is flying, the oncoming airflow will blow over this hole and cause the regulator to work incorrectly, and this makes it very difficult to properly adjust the needle valves. Also, if the engine is inside a cowl, the internal cowl pressure can change during different maneuvers, further complicating the situation. I once had a TOC plane whose engine would go very rich whenever I added right rudder in a rolling circle. Go figure!

If you experience these kinds of problems with your carb, you may need to isolate the pressure variations. Sometimes, a simple cover placed over the hole is all that's needed to prevent the problem. In more extreme cases, modelers have found that the only way to solve the pump-pressure fluctuation is to carefully install a pressure fitting in the small hole and then vent the carb to the static air pressure within the fuselage with a length of fuel line. Thankfully, my new 3W 140 is very happy when it's left alone, but all engine installations differ.

Sometimes, a small cover over the air-pressure hole is all that's needed to solve the fuel-mixture-adjustment problem. In this case, I used a trimmed-down nylon pushrod exit guide as a wind deflector.

This is a 3W 24 carburetor with an extension added to the throttle arm (it comes with the engine). I strongly suggest you use one. If the engine manufacturer does not provide it, you need to fabricate one. This engine is being used on a Hangar 9* CAP 232.



THE 90-DEGREE RULE

I have mentioned this before, but it's very important. The 90-degree rule simply requires that the servo and throttle arms be exactly at the mid-position at the ½-throttle setting and at equal angles at the high- and low-throttle positions (see Figure 1). If this is not done, there will be some unequal throttle response relative to the stick position. This is a very common problem that is easily fixed with a little planning. Though proper throttle-linkage geometry may seem a minor point, it is an important part of having smooth, consistent throttle response.

LONGER ARMS ARE BETTER

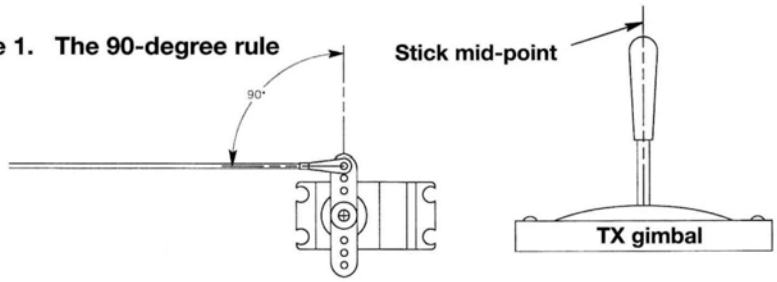
Because they weren't designed for RC, the throttle arms on gas carbs are almost always too short. I strongly recommend that you add an extension to the arm and use a good-quality, ball-bearing servo. The extra arm length gives better servo-control resolution and allows finer throttle adjustment. I don't recommend using a plastic pushrod for the full length of the throttle linkage. If you do, take time to make sure that you properly support the pushrod with a precision installation to minimize "play."

Once the throttle-linkage and servo-throw endpoints have been properly set up, you can use your TX's programming to fine-tune the throttle response. Run the engine and use the "throttle curve" function to achieve linear throttle response relative to the entire throttle/stick travel. This takes some practice and an acquired "feel," but one thing you don't want is to have what feels like full power at the mid-throttle stick position with little change in power from the mid-point to the full-throttle stick position. Your plane will be much easier to control, and you will fly with much greater confidence.

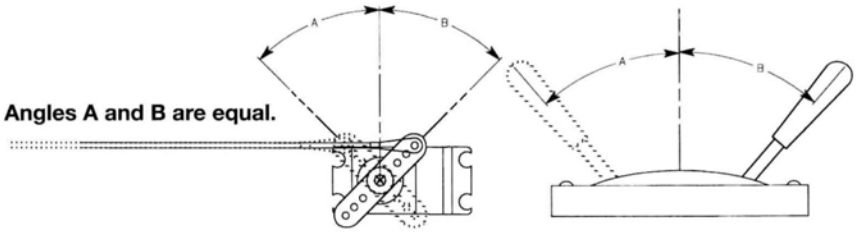
Gasoline engines have a lot going for them; once you've considered all the variables, you'll find them an excellent choice for powering your giant airplanes. Understanding gas carbs and installing throttle linkages properly will give you the best performance and the most enjoyment. If you haven't considered gas power before, maybe it's time you did!

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

Figure 1. The 90-degree rule



At the mid-throttle stick position, the angle between the servo arm and the throttle pushrod is 90 degrees.



When the throttle stick is at its full high and low positions, the angles between the servo arm's high and low positions and the mid-position are equal.

PRODUCT WATCH

Editors' picks of the month

AT MODEL AIRPLANE NEWS, we not only tell you what's new, but we try it out first to bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

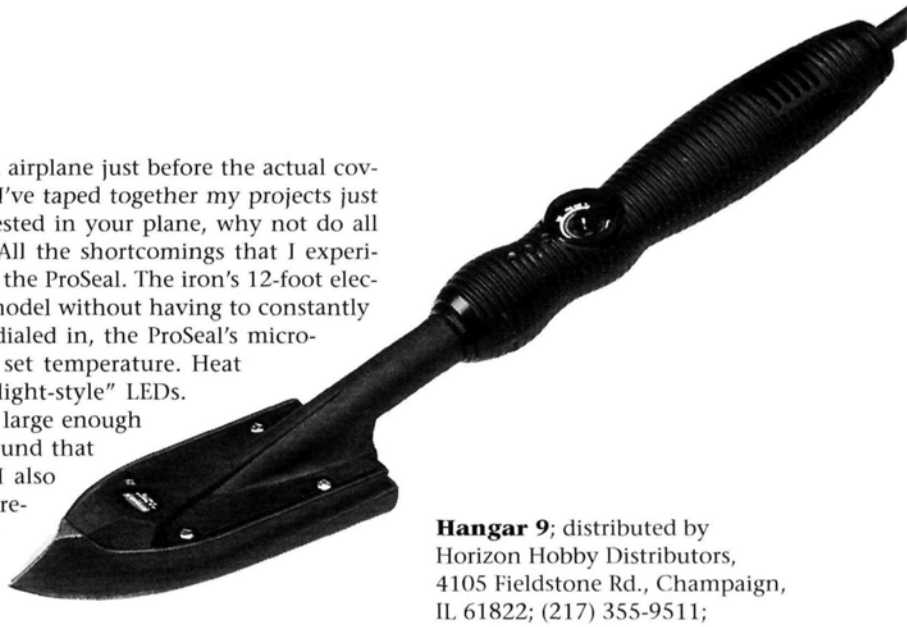
HANGAR 9

ProSeal Covering Iron

Gotcha covered

I love looking at the fully framed and assembled airplane just before the actual covering goes on. I can't tell you how many times I've taped together my projects just to see their finished forms. After all you've invested in your plane, why not do all you can to ensure a top quality covering job? All the shortcomings that I experienced with other covering irons are remedied by the ProSeal. The iron's 12-foot electrical cord allows you to reach all parts of your model without having to constantly flip it around. Once the temperature has been dialed in, the ProSeal's microprocessor-controlled thermostat maintains the set temperature. Heat status is always visible with the iron's "traffic-light-style" LEDs. Also unique is its Teflon-coated shoe design: it's large enough to seal and shrink the big surface areas, and I found that the narrow "chisel" nose fits in most corners. I also like the ProSeal's rounded bottom edges that prevent the iron from digging into your plane's precious surface. The iron feels solid, and the nonslip handle is comfortable to hold during lengthy covering sessions. Price—$27.95.

—Bob Hastings



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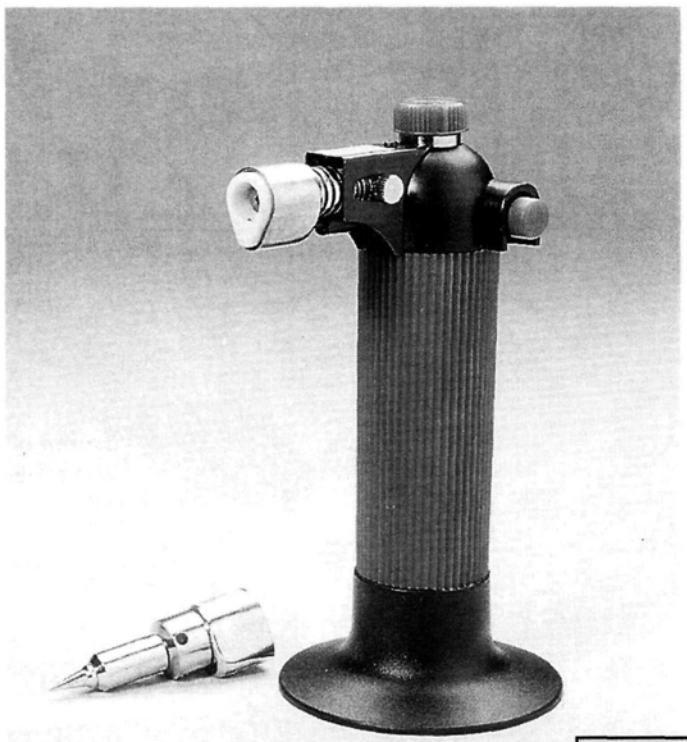


HOBBICO

Hobby Heat Pro Piezo Micro Torch

Come on, baby, light my fire!

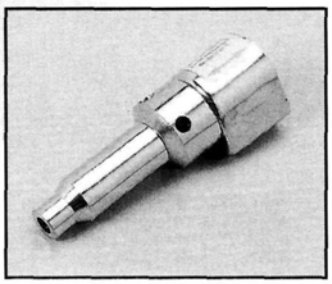
This offering from Hobbico will make your life a bit easier. The Hobby Heat Pro Piezo Micro Torch is a butane torch, soldering iron and heat gun, all in one. Its 20cc capacity means that you'll get about 90 minutes of total use before you need to refill it, and the filling valve on the bottom allows you to refill with butane quickly. The torch's 5.9-inch height, 3.1-inch width and 7-ounce filled weight mean you'll be able to take it everywhere!

To start the torch, turn the knob on the top, then press the side button. If you need a soldering iron, slip on the soldering tip, turn on the torch, slide the shuttle lever forward for a few seconds, and you're ready. Do the same thing for the hot-air blow tip, which is available separately. Don't worry about not having enough heat, either. The butane torch reaches temperatures of up to 2,372 degrees Fahrenheit; the soldering tip gets up to 752 degrees F; and the hot-air blow tip reaches 932 degrees F.

With the Hobby Heat Pro Piezo Micro Torch you can solder and braze, heat-shrink, bend plastic, touch up covering film and remove epoxy. It could be the best thing you've added to your flight box or bench since batteries!

Prices—torch and soldering tip (HCAR0760)—$39.99; hot-air blow tip (HCAR0761)—$9.99.

—Geoff Cozine



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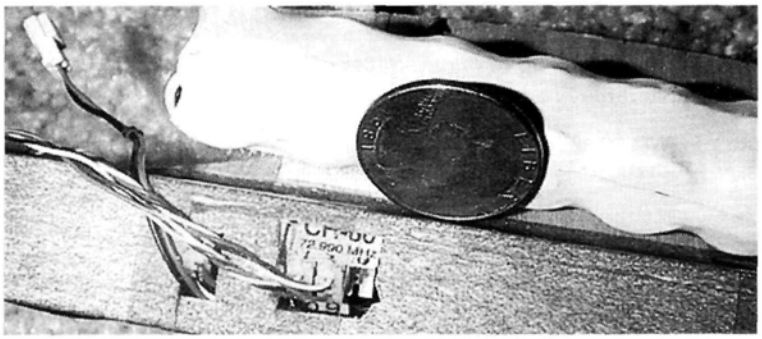
SKY HOOKS & RIGGING

RX72 Hybrid Receiver



Lightweight ESC/receiver combo

When this receiver arrived on my doorstep, the box was so light, I thought it was empty. A little searching revealed one RX72 hybrid receiver from Sky Hooks & Rigging within the empty space. You've gotta see this thing! It is so tiny--a postage stamp-size package that weighs almost nothing: 3.5 grams (⅛ ounce)! It is designated a hybrid because its tiny package contains both a receiver and an electronic speed controller (ESC). This combination saves weight by eliminating the wiring and cases of two separate units.

To save more weight, I replaced my servo connectors with the supplied "microconnectors"—small block connectors with thinner wires better suited to tiny aircraft. This modification saved about 1.4 grams for the two servos. Not huge, but on a model that weighs 119 grams (4.2 ounces), every little bit (1.2 percent) helps! Beware, though; changing connectors may void your warranty.

I installed the gear into my Aika glider. I had wanted longer flights out of it ever since I read about its one-hour flights in the September 1999 issue of *Model Airplane News*. The conversion was straightforward: I removed the CO_2 engine and installed a Puma 05 geared motor from Hobby Club. I installed the hybrid into the existing hatch area, secured the RX72's long antenna to the rear of the fuselage and allowed the excess to trail behind.

I attached the two servos with double-sided tape to the Aika's fuselage, and incorporated the included switch harness to connect the receiver to the motor and battery and also to provide a charge jack; the battery doesn't need to be removed for charging. I positioned all of the gear so that the CG was the same with or without a battery, so substituting other batteries, placed at the CG, wouldn't affect the balance. I used hook-and-loop fastener to secure the battery to the pylon under the wing.

The receiver was shipped with the throttle output in the proper channel number. Be sure to order one that matches your transmitter. The default throttle-on direction turned out to be backward, so I reversed the throttle channel. I adjusted the throttle settings to begin supplying power at the desired stick position and to give full power near the top of the stick's travel. This is easily done by watching the receiver's hidden LED: no light—off, a blinking light—partial throttle, and a steady light—full throttle.

SPECIFICATIONS

(as supplied by manufacturer)

Weight: 3.5g (0.125 oz.) complete

Servo channels: 3 (plus 1 dedicated speed-control output)

Dimensions: 0.938x0.75x0.25 in. (23.8x19.1x6.4 mm)

Range: 1,000 ft. (300m)

Current drain: 15mA @ 5 volts

Available 72MHz channels: 11 through 60, crystal controlled

RF input bandwidth: ±76 kHz (not narrowband)

Connector type: SH&R "microconnectors" (non-standard)

Input voltage range: 6 to 10.5V (maximum 15V)

Current: 4 amps continuous, 6 amps maximum

"Chopping" frequency: 3kHz

Battery eliminator circuit: maximum 0.8 amp at 5 volts

Fail-safe: Motor current stopped on loss of signal

Safety features: Soft start (waits for low throttle before powering motor)

TESTING CONFIGURATION

Transmitter: Futaba 8UAPS

Airborne battery: 6, 110mAh Sanyo cells

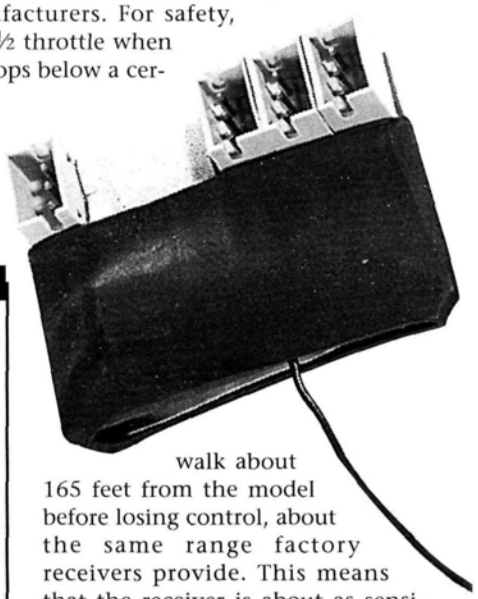
Flight motor: Puma 05 geared (Hobby Club)

Aircraft: Aika (Hobby Club)

Flying weight: 120g (4.25 oz.) with 6-cell battery

The unit worked well and never appeared to get hot during operation. I did notice that the ESC isn't quite linear, or uniform, in its response to throttle stick. It seems to advance smoothly for about 80 percent of the stick's travel, then it jumps to full throttle. When the battery voltage drops low enough, both of the servos become jittery as the control tries to get motor and servo current out of a battery that can't quite deliver both, but this is normal behavior when battery voltage drops.

I verified that the speed control would only power up the motor if the throttle stick was at idle, regardless of the order in which the transmitter and receiver were turned on. This is a really nice feature that should be adopted by all speed-control manufacturers. For safety, the unit also goes to ½ throttle when the battery voltage drops below a certain level.



During a range test with my transmitter's antenna collapsed, I was able to walk about 165 feet from the model before losing control, about the same range factory receivers provide. This means that the receiver is about as sensitive as a factory model. Note, however, that it is not as "selective" as current narrowband receivers. Since the hybrid has a 76kHz bandwidth, you'll need to grab an 80kHz swath (four 10kHz channels on each side of your desired frequency) from the frequency control board to avoid interference from other transmitters. Remember, however, that this receiver is intended for situations where there are only a couple of aircraft flying at a time, so the lack of selectivity shouldn't be too much of a problem.

If your field is crowded and selectivity is a problem, you'll be pleased to know that SH&R is introducing a narrowband receiver that will only be 1 gram heavier: 4.5 grams. I'll certainly be interested to see those babies when they're available!

I enjoyed test flying the hybrid receiver, and I look forward to using it in the future for fun sport-flying! I now have another model I can fly in my driveway! The folks in my model club are probably wondering why they never see me; it's because I can fly in my yard or at a park five minutes away. I no longer need a big flying field!

—Don Edberg

Sky Hooks & Rigging; Tom McCann; 2206 Towne Blvd., Oakville, Ontario, Canada, L6H-5H4; (905) 257-2101; fax (905) 257-0168; mi@media-interactive.com; www.indoorrc.com.

NAME THAT PLANE

Can you identify this aircraft?

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Congratulations to Windsor Whittle of Memphis, TN, who picked out the January 2000 mystery plane via a "wild guess." Windsor correctly identified the Douglas XA2D-1 Skyshark. The Skyshark was designed as a successor to the Douglas Skyraider and originally used many of that plane's components. To meet strength, stability and equipment requirements, the experimental plane's airframe was almost completely redesigned. The Skyshark was the first postwar tactical plane powered by a turboprop engine—the 5,850hp Allison T-40. Its engine was mated with twin, counter-rotating propellers that gave it a unique appearance. Because of delays in engine production, the 50-foot-span aircraft was limited to an initial run of only 10.

The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free, one-year extension of his subscription.

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BUSINESS

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WANTED: 1950s plans for Mechanix Illustrated "snark" missile; Jetex-powered catapult launch. Fred Richmond, 324 Hills St., Chittenango, NY 13037. [03/00]

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WANTED: ALL TOY METAL OUTBOARD MOTORS. Electric, wind-up and gas. Also wanted: .60-size spark ignition motors, thimble drone, etc., racecars. Call Richard, (231) 941-2111. [02/01]

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WANTED: Classic Glass F4F-1 Wildcat, 1/5-scale kit, any condition. William Hawke, Box 558, Milford, NJ 08848; (908) 996-6000. [3/00]

WANTED: Leica camera outfit. Working or not. Virgil Frederiksen, P.O. Box 60781, Boulder City, NV 89006; (702) 293-7800. [5/00]

MODEL AIRPLANE NEWS, 1930-1980. "Air Trails," 1935-1952, "Young Men," 1952-1956, "American Modeler," 1957-1967, "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C., Canada V0R 1L1. [6/00]

WANTED: 1 set of plans for a Victor P-68, as kitted by Royal Products with 63-inch wingspan. Royal no longer in business? Must be in good condition or a good copy. Al Klashak, (517) 835-3350, or email wacouic@juno.com. [3/00]

EVENTS

ROANOKE VALLEY RADIO CONTROL. 22nd RC Model Aircraft Swap Shop and Auction. March 11, 2000, Roanoke Civic Center Exhibit Hall, Roanoke, VA. Over 100 tables, huge static contest; cash awards. Concessions, door prizes. 10 a.m. to 3 p.m. Admission $4. Age 12 and under, free. Tables, $8 each. First come, first served. Hobby shops on site. For event information, contact Mike Stubbs, (540) 563-9635. More info on our website: www.rvrc.org. Static info: Russell Stiff, (540) 977-0402. [3/00]

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Aeroloft, 7919 E. Mawson Rd., Mesa, AZ 85207; (480) 380-4799; fax (480) 380-4843; www.aeroloft.com.

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AstroFlight Inc., 13311 Beach Ave., Marina del Rey, CA 90292; (310) 821-6242; fax (310) 822-6637; www.astroflight.com.

B&T R/C Products, 508 Lake Winds Trail, Rougemont, NC 27572; phone/fax (919) 471-2060.

Balsa Products Engineering, 122 Jansen Ave., Iselin, NJ 08830-2601; (732) 634-6131; www.balsapr.com.

Bisson Custom Mufflers, RR 1 Taits Island, Box 32, Parry Sound, Ontario, Canada P2A 2W7; (705) 389-1156; (705) 389-1156.

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Small hills, big air

SLOPE-SOARING PILOTS USUALLY favor big hills. We dream of trips to Eagle Butte, WA, Torrey Pines, CA, Sleeping Bear Dunes, MI, and Jockey's Ridge, NC. We long to find that magic mountain in our own neighborhood—one with plenty of height, no trees, few upwind obstacles and easy access to the top. Our problem is that these classic sites are few and far between, but one solution is to look through new eyes at small slope sites.

I recently spent a week flying with a remarkable slope-sailplane designer, maker and pilot—Dave Sanders of Dave's Aircraft Works. He taught me a great deal about base soaring, including the reason he prefers small-hill, big-air soaring instead of that "Holy Grail" of big hills that we're all searching for.

It's important to understand the concept behind small-hill, big-air soaring because there are many more soarable small hills in this world than there are big hills. With a change of focus and the right sailplane, you can double, triple, or even quadruple the number of slope-soaring sites available within an hour's or a day's drive from your balsa or foam dungeon.

I watched Dave Sanders fly off an 18-foot coastal hill for three days. Dave selected this small hill rather than the nearby 100-foot hill that we usually fly from. Hey; no hoofing it up the hill; you can't argue with that! Dave mostly flew a DAW Kawasaki Ki-61 EPP mini-foamie—a 30-inch-span slope plane designed for a bungee launch and small hills with moderate lift. He also flew his semi-scale, 117-inch-span Schleicher Ka-6E aerotow trainer—the largest EPP-foam plane in production today.

Most of the time, Dave couldn't keep the grin off his face. While observing his flights and talking with him afterward, I learned the basics of small-hill, big-air slope flying:

1. Select a plane with a fat airfoil. Although they're currently out of favor with slope-plane designers because speed is so important to many of them, thicker airfoils give high lift at low speeds, and they offer gentle, predictable stall characteristics. Both are important for close-in aerobatics and for plain ol' low-and-slow flying.
2. Fly a sailplane you're familiar with. Since you generally fly lower than one mistake high, the better you know the plane, the more successful you'll be at keeping it aloft in a narrow lift band.
3. Find a flying site that's smaller than you're used to but that is unobstructed out front. Dave and I flew over an 18-foot dune and a 3-foot guardrail. The key to getting enough lift from these particular bumps was the water out front—no obstructions to create turbulence. An ocean, lake, or river is ideal, but a flat field will do almost as well.
4. Locate the hot spots on the hill, and use them to obtain a boost of energy on each pass. Our small hill had a convoluted face that offered bowls to concentrate lift and higher spots from which to get a boost in speed and altitude. Half a dozen cars were parked by the guardrail. At one time, a pair of mini vans were there, and they provided great lift. Dave used these spots on each pass, building altitude and gathering speed to complete each circuit.

Using these techniques, Dave flew his mini-foamie Ki-61 and big Ka-6E. He flew the Ki-61 for hours, taking full advantage of the lift provided by the metal guardrail that separated the parking lot from the gently sloping beach. Following his lead, I launched my trusty Bob Martin Coyote from the beach into the 18-foot hill's hot spot, and after a wobbly start, I flew it for a while over the small hill, often crossing the 200-foot gap between the ridge and the parking lot and flying over to the big hill to build altitude. After some practice, I even flew the guardrail. The Coyote lived through the experience, and I now have two new arrows in my slope-soaring quiver: launching from the bottom and flying tiny slopes.

Vacation trips to mega slopes are wonderful, but when you're short on travel time, consider building a suitable plane and finding a nearby spot where you can try small-hill, big-air slope flying.

PHOTOS BY DAVE GARWOOD